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U. S. DEPARTMENT OF LABOR BUREAU OF LABOR STATISTICS

ROYAL MEEKER, Commissioner

BULLETIN OF THE UNITED STATES
BUREAU OF LABOR STATISTICS

{ WHOLE
NUMBER 205

INDUSTRIAL ACCIDENTS AND HYGIENE SERIES: No. 10

ANTHRAX AS AN OC- CUPATIONAL DISEASE

By JOHN B. ANDREWS, Ph. D.



JANUARY, 1917

WASHINGTON
GOVERNMENT PRINTING OFFICE
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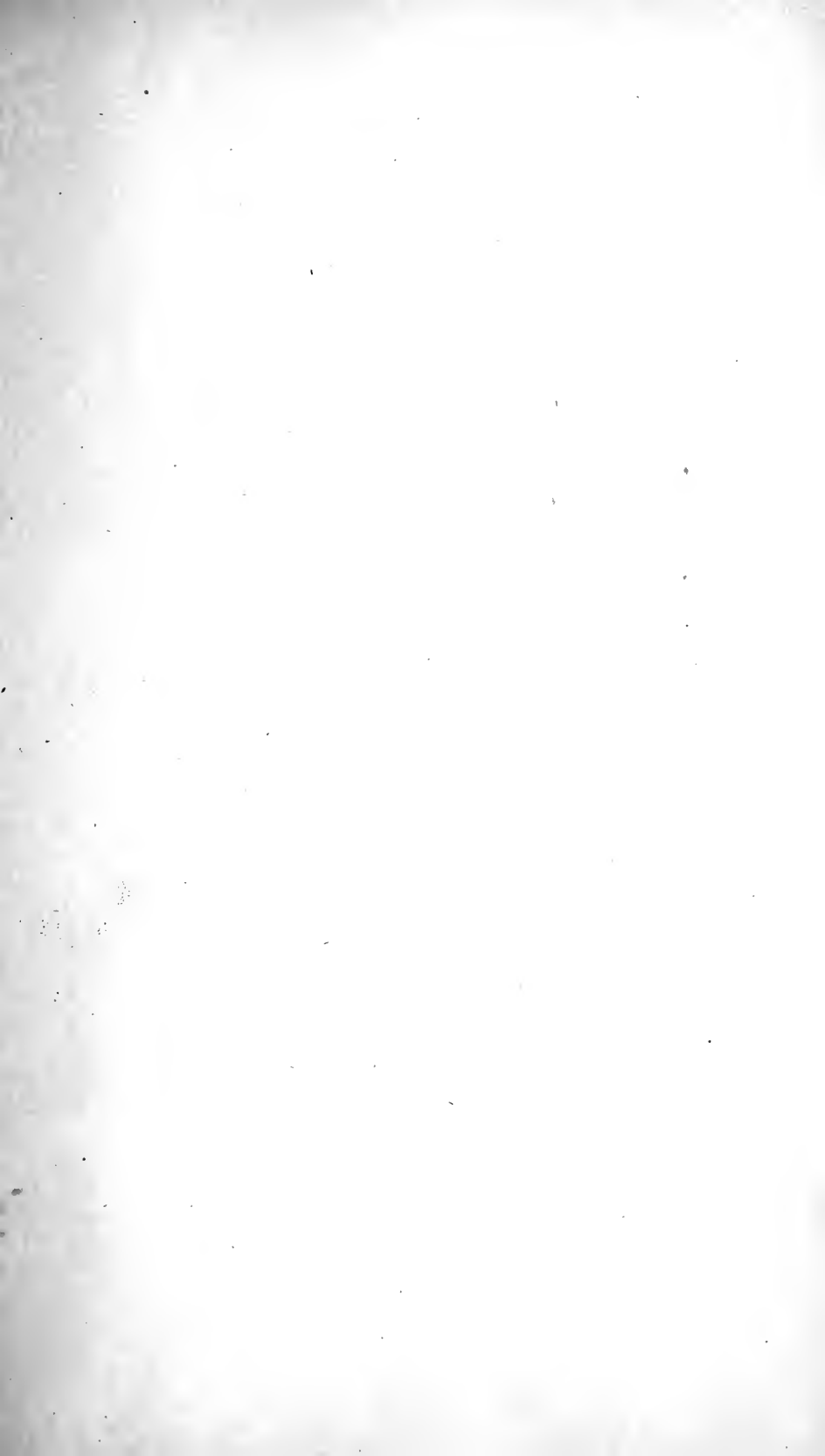
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JANUARY, 1917.

ANTHRAX AS AN OCCUPATIONAL DISEASE.

BY JOHN B. ANDREWS, PH. D.¹

INTRODUCTORY SUMMARY.

A sudden and startling increase in the number of illnesses and deaths from anthrax in the United States drew public attention to this occupational disease during the closing months of 1915 and the early part of 1916. Most of the increase took place in seaports and tannery towns in the three States of New York, Massachusetts, and Pennsylvania. New York, for instance, reported more deaths from the malady in 1915 than had previously occurred in any State in any single year since the Census Bureau began to give anthrax a separate place in the mortality statistics. In Massachusetts more cases were reported during the first six months of 1916 than in any preceding whole year since the infectious disease reporting law in that State went into effect.

The relative importance of anthrax is shown by the fact that for every five deaths from lead poisoning reported in the United States registration area there is one death from anthrax, and that the total number of anthrax cases is about five times the number of fatalities. One Delaware physician was able to furnish, from his own practice, data on 48 cases treated within six years. During the same period a single Philadelphia hospital treated 32 cases, 6 of which were fatal. In three years one State workmen's compensation commission passed upon 30 claims arising from this occupational disease.

Anthrax is primarily a disease of animals such as cattle and sheep, but is transmitted to man in a number of industrial pursuits. Included among those who have died of it in this country are hide and skin handlers and other tannery employees, longshoremen, wool-

¹ Of information from scores of physicians, hospitals, and public officials in this country and Europe during the past five years, and of painstaking analysis by two faithful assistants, Anna Kalet and Solon de Leon, grateful acknowledgment is here made.

sorters, hair workers, brush makers, paper makers, farmers, ranchmen, liverymen, and veterinarians. Among nonfatal cases reported in several States and by a number of hospitals the same groups of occupations are strongly represented. Infection has even taken place in a carpenter, a steam fitter, and a stationary engineer, all of whom worked in tanneries, and in a customhouse official who weighed hides and wool on the docks. In some nonoccupational cases the disease has been spread by insects and by pet animals which had been feeding on diseased carcasses.

The bacillus of anthrax is one of the largest and most easily recognized of disease-producing organisms, and its discovery about the middle of the last century marks the beginning of modern bacteriology. The bacillus, however, is not so much to be feared as a cause of disease as the spore, which is so resistant that it is used as a test object for standardizing germicides. The spore can survive for as long as 17 years without nutriment, is easily carried about, and when provided with a favorable environment rapidly germinates and sets up a focus of infection.

In man contagion commonly occurs through an abrasion of the skin, resulting in the so-called "malignant pustule" or in "malignant edema." Woollorter's disease, or pulmonary anthrax, is a less frequent but almost invariably fatal form of the malady, caused by inhaling dust or particles of hair or wool from diseased animals. In rare cases the spores find entrance to the digestive system and produce a gastrointestinal attack. The method of treatment most frequently used hitherto is excision of the pustule where possible, sometimes supplemented by intravenous injections of antianthrax serum. Now, however, some successful physicians are advocating for external cases nothing more drastic than rest for the affected part, stimulants, and local treatment with iodine and wet bichloride of mercury dressings. Often in internal cases, physicians admit, the disease fails to be diagnosed and its discovery is a "surprise of the autopsy."

In Europe both private and public forces have combined to carry on an energetic campaign against industrial anthrax. The Anthrax Investigation Board for Bradford and District, in England, the German and the French employers' mutual trade associations, and the famous Labor Clinic at Milan, Italy, have all made valuable studies of the disease and assisted in establishing preventive measures. The governments of the leading countries long ago drafted and secured the careful enforcement of sanitary rules for the dangerous industries, including wool sorting, washing, combing, and carding, hair sorting, brush making, and tanning. Further researches in efficient and practicable methods of disinfection are still under way.

In at least seven foreign countries anthrax is compensated as an industrial accident.

In the United States, on the other hand, the problem has as yet been given less consideration, although legislation for the reporting of anthrax, both as an infectious and as an occupational disease, is now fairly widespread and in some progressive States valuable data are regularly being collected.

In the field of prevention, especially, the United States lags behind. Precautions taken by employers on their own initiative are crude and few in number. Antianthrax serum is scarce and not readily available. No specific factory or workshop regulations for safeguarding working men and women from the disease have yet been enacted by any State. The most effective American provisions on the subject are contained in joint administrative orders of the Federal Departments of the Treasury and Agriculture, which, beginning January 1, 1917, prohibits the importation of hides, hoofs, wool, hair, or other products from animals affected with anthrax and establishes detailed requirements for the disinfection of these products if imported from districts where anthrax is prevalent and for the disinfection of conveyances and of certain premises. The period during 1915 and 1916 when much laxer requirements were in force corresponds roughly with the period of highest anthrax frequency yet recorded in the United States, especially among long-shoremen and tannery employees, and the connection would seem to be more than accidental.

Two States authorize workmen's compensation for all anthrax contracted in the course of employment, and in one State (Massachusetts) a score of awards under this enlightened principle have already been rendered. In a few other States compensation payments have been made for anthrax contracted as the result of a definite injury received while at work. With the gradual spread of workmen's compensation to include all personal injuries in the course of employment, and with the probable development of health insurance in this country, an added incentive will be furnished for the prevention of this deadly disease.

CHAPTER I.

GENERAL DESCRIPTION AND HISTORY OF ANTHRAX.

EARLY STUDIES OF THE DISEASE.

It was not until the latter half of the eighteenth century that valuable treatises on the subject of anthrax or splenic fever (French, "charbon"; German, "Milzbrand") began to appear.¹ In 1769 Fournier, of Dijon, France, published his historic work "Charbon Malin," wherein a step was made toward recognizing the connection between the various forms of anthrax. At about the same time the ravages of the disease became so serious and the need for a remedy so urgent that the Academy of Dijon offered a prize for essays on the subject. Some of the works submitted were remarkable for the thoroughness and precision with which they described the main symptoms of human anthrax. These first scientific researches practically mark the beginning of the literature. Since then, at more or less regular intervals, treatises on the disease, both in man and in animals, have continued to appear.

It was not, however, until a century later that the true nature of anthrax was revealed. In France in 1849 an investigation was undertaken by a group of medical men, in the course of which it was established that anthrax in man and anthrax in animals are identical. Then began a search for the causes of the disease. The theories advanced are characteristic of the ante-Pasteur period when the mysteries of bacteriology were still undisclosed and infectious diseases were explained by spontaneous generation and by other subsequently discarded hypotheses. For anthrax, the influence of soil, the summer's heat, storms, insanitary conditions of stalls and stables, and errors in diet² were some of the causes assigned.

¹ The origin of anthrax is lost in antiquity. Some authors trace it even to the time of Moses and identify it with the sixth plague of Egypt. Allusions to it are believed to be found in Homer. Virgil at the end of the Third Georgic gives a very vivid description of an outbreak among domestic animals, the symptoms of which leave little doubt as to its being anthrax. Hippocrates, Galen, and Pliny the Elder all describe carbuncles, which are diagnosed as anthrax by some modern authorities. Periodic devastating epidemics of the disease are mentioned by numerous writers, medieval and modern.

² Thus Delafond, a French veterinary surgeon, held at one time that anthrax in sheep was caused by "an excess of blood circulating in the vessels," due to "too copious and too substantial feeding." (Delafond: *Traité sur la maladie du sang des bêtes à laine*, 1843. Quoted by J. Cavallé: *Le Charbon Professionnel*, 1911, p. 8.) At a still earlier date Chabert, director and inspector general of the Royal Veterinarian College of France, declared that "anthrax tumors in general may, and should, be regarded as the effects of an effort of nature to rid itself of the humor with which it is surcharged and the expulsion of which it is important to assist by all means that may achieve this result." (*Traité du charbon ou anthrax dans les animaux*, Paris, 1782, p. 33.)

DISCOVERY OF THE BACILLUS.

The anthrax bacillus was the first bacterium of disease ever discovered, and its isolation marks the birth of the modern science of bacteriology. In 1850 a French village physician named Rayer, in collaboration with Davaine, found in the blood of a sheep which had died of anthrax what he called "little threadlike, motionless bodies, about twice the length of a blood globule."¹ Five years later, in 1855, a similar result was obtained by a German scientist, Pollender. None of these men at the time of their discovery, however, was able to explain the nature of these bodies or their relation to the disease, nor was anyone aware of the greatness of their contribution to human knowledge.

Davaine, after a long series of experiments, came to the conclusion that these bodies, constantly present in the blood and organs of animals dying of anthrax, were absolutely distinct from the bacteria of putrefaction which were being studied by his contemporaries, and that in them would undoubtedly be found the cause of the disease.² This forecast was brilliantly fulfilled in 1876 by Robert Koch, who later discovered the bacillus of tuberculosis. Koch conclusively proved³ the causal relation of the bacterium to the disease, and furthermore demonstrated that the anthrax organism passed through the two stages of bacillus and spore which had previously been made out by Pasteur in connection with a silkworm blight.

At this point Pasteur took up the inquiry. The fact that certain investigators, even after Koch's demonstration, maintained that the disease often occurred without the presence of bacteria led him to subject the work of his predecessors to rigorous verification. He resorted to the method of successive cultures. In a nutritive liquid he placed a minute quantity of fresh anthrax blood; a large number of bacteria appeared; a drop of this liquid produced a new culture which also showed germs, and so on to 20 cultures. Since the last culture certainly contained not a particle of the original anthrax blood, and since it had the power to produce anthrax by inoculation, Pasteur decided that it was not blood, but bacteria, that constituted the cause of anthrax. He also verified Koch's observations of the reproduction of the bacteria through fission and by spores. The experiments of these men, by presenting for the first time a complete account of the etiology of anthrax, answered the most important question in connection with this disease and made possible its further scientific study.

¹ Comptes rendus de la Société de Biologie, 1850, p. 141. Quoted by J. Cavaillé: *Le Charbon Professionnel*, 1911, p. 11.

² Comptes rendus de l'Académie des Sciences, 1863, vol. 57, pp. 320, 351. Quoted by J. Cavaillé, *op. cit.*, p. 14.

³ Robert Koch: *Die Aetiologie der Milzbrandkrankheit begründet auf die Entwicklungsgeschichte des Bacillus Anthracis*, 1876. Leipzig, 1910. 47 pp.

CHARACTERISTICS OF BACILLUS AND SPORE.

The bacillus of anthrax (*Bacillus anthracis*) is a cylindrical or rodlike body of $\frac{1}{5000}$ to $\frac{1}{2500}$ inch in length and about $\frac{1}{25000}$ inch in diameter. Viewed with a microscope it is motionless, straight, and transparent. In the blood and other fluids of a living animal, which form the most favorable media, the bacillus multiplies very rapidly by fission. The rodlike body becomes longer and divides into two or more individuals similar to the parent. The multiplication of the bacillus can take place only in the presence of substances entering into the composition of the bacillus itself, namely, water, nitrates, carbohydrates, and minerals; a temperature of 53.6° to 113° F. and a supply of oxygen are also necessary.

Another mode of reproduction is by means of spores. Spores can be formed in a medium similar to that favorable to the segmentation of the bacillus, except that free oxygen is necessary; for this reason spores never form in the blood of a living animal. Given the presence of free oxygen, sporulation takes place when the medium becomes "impaired, either because it was deprived by the bacillus of some of its essential substances or because it became adulterated by the accumulation of products secreted by the microbe."¹ Under such conditions the bacillus instead of dividing into segments grows into a long thread inside of which oval-shaped spores appear, regularly spaced, "like peas in a pod." The surrounding protoplasm is dissolved or reabsorbed, and the spores are liberated. Thus the spore seems to be formed at the expense of the bacillus itself; it is, so to speak, the bacillus in a condensed form, and when placed in a favorable medium it germinates and again becomes a bacillus. The spore has been the subject of numerous researches and its nature is well known. It has been discovered that, unlike the bacillus, the spore is marvelously resistant, a circumstance which makes the struggle with the disease particularly difficult. The spore contains in itself the elements necessary for life and can subsist for years in an environment entirely devoid of nutritive materials, while the bacillus, left to itself, very soon dies. Dr. Rebentisch,² of Offenbach, Prussia, states that after having lain dormant for 17 years the spore is still capable of germination.

In their susceptibility to heat, the microorganisms also differ considerably. Blood of anthrax-infected animals, containing bacilli only, loses its virulence if exposed for 15 minutes to a temperature of 131° F. The spore, however, is much more resistant. Two hours of boiling are required to kill all spores contained in a liquid culture; raised in such a medium to 221° F. a few spores may resist for about

¹ J. Cavaillé: *Le Charbon Professionnel*, Berger-Levrault, éditeurs, Paris, 1911, p. 43.

² Gewerbliche Milzbrandvergiftungen, in *Zentralblatt für Gewerbehygiene*, May, 1913, p. 201.

15 minutes. In a dry medium the spores stand a temperature of 248° to 266° F. Drying, if carried out rapidly, destroys the bacillus but hardly affects the spore.

Equally resistant is the spore to antiseptics; numerous experiments have shown that while the bacillus is easily destroyed, only very high doses and prolonged exposure have any effect on the spore. Nammack states that "even catgut, prepared from the submucosa of the intestines of infected sheep, has been known to defy all the elaborate preparations of modern surgical technique, and still convey anthrax infection to a wound."¹ In fact, so hardy are the spores that they have long been used as test objects for determining the efficacy of germicides and of other destructive agencies.² This circumstance explains the difficulties in the way of sterilization of materials, a question which will be taken up later in detail.

ANIMALS SUBJECT TO ANTHRAX, AND COUNTRIES WHERE THE DISEASE IS PREVALENT.

Anthrax is primarily a disease of animals, from whom it is contracted directly or indirectly by human beings. It is particularly frequent among cattle and sheep, but may also be transmitted to goats, horses, hogs, dogs, cats, and certain kinds of game. Mice, rabbits, and guinea pigs, in the laboratory experiments, are very susceptible, while fowl are practically immune. This considerable variety of animals subject to anthrax aggravates the dangers of the disease.

Another serious factor is its world-wide distribution. Hardly a country in the world is known to be entirely exempt, while a number of localities are reputed to be particularly affected. Of the European countries, Russia and Italy are reported to be most severely affected by both animal and human anthrax. Well-enforced laws prescribing preventive vaccination of animals and complete destruction of carcasses have succeeded in making it comparatively rare in England, Germany, France, and a few other European countries. In the United States, anthrax is frequent among animals in the lower Mississippi Valley, in the Gulf States, in the East (chiefly on the banks of the Delaware River), and in some of the Western States. On the South American Continent it is prevalent in the less civilized districts of Argentina, and in Patagonia and Uruguay. The worst ravages of the disease, however, are reported from Asiatic countries, mainly Siberia, Persia, Asia Minor, Tibet, China, and India, where physiographical conditions, deplorable ignorance, and utter indifference conspire to make the materials exported from those countries the most dangerous known to anthrax experts.

¹ Charles E. Nammack: A Case of Anthrax; Excision; Recovery, in *New York Medical Journal*, 1897, vol. 66, p. 80.

² E. O. Jordan: *General Bacteriology*, 1912, p. 217.

CONDITIONS OF SOIL AND TEMPERATURE FAVORABLE TO THE DEVELOPMENT OF ANTHRAX.

The frequency of animal anthrax in certain countries is explained not only by the absence of precautionary measures, the most urgent of which are preventive vaccination, complete destruction of carcasses, and rational disposal of waste products of manufacture, but also by conditions of soil and temperature. Anthrax is mainly observed on black, loose, humus soils, also on swampy land under which impervious strata are found. Outbreaks are frequent in places where spring inundations, which frequently wash over unburied carcasses, are followed by a dry hot summer. The moisture contained in these kinds of soil, and the organic matter always abundant, furnish, if combined with favorable temperature, an excellent medium for the development of bacilli and spores when, after the inundation, the land dries, and the germs are either left in the ground or disseminated by the wind.

MODES OF INFECTION.

Most cases of animal anthrax are attributed to infection from fodder, either through grazing on fields where carcasses of victims of the disease have been left, or through eating hay cut from such fields. Water from streams receiving discharges from establishments using infected material, artificial manure, and imported food-stuffs are also frequent causes.¹ Transmission through blood-sucking insects has been experimentally demonstrated,² but only rarely is the disease due to the entrance of germs into the air passages, and seldom does it occur in animals through infection of wounds.

Human beings contract the disease mainly through the handling of infected animal materials, either when these materials are obtained by them directly from animals or else when they are being transported or manipulated in industrial processes. Workers handling infected goods sometimes transmit the disease to members of their families, either by means of clothing³ or through contact, while they themselves may escape. Bites of insects and even of pet animals which presumably had been feeding on diseased material have been known to convey the infection, and in some cases the eating of diseased meat has been suspected. A certain number of cases are also due to the spores which have sometimes been found in shaving brushes.

¹ In November, 1915, for instance, an anthrax outbreak occurred among the cattle of farmers owning grass lands along the Johns River, N. H., who fed their live stock hay cut from those lands. According to the State department of agriculture, the trouble seemed to arise from a tannery which emptied its waste into the river. A State veterinarian contracted the disease while making a post-mortem examination, but recovered. See also pp. 28 and 30.

² M. B. Mitzmain: Experimental Transmission of Anthrax, reprint No. 162 from the U. S. Public Health Reports.

³ The Journal of the American Medical Association for Apr. 26, 1913, for instance, contained an account of a woman in London who contracted anthrax presumably from the clothes of her husband, who was a laborer handling hides.



APPEARANCE OF ANTHRAX BACILLI AND SPORES.

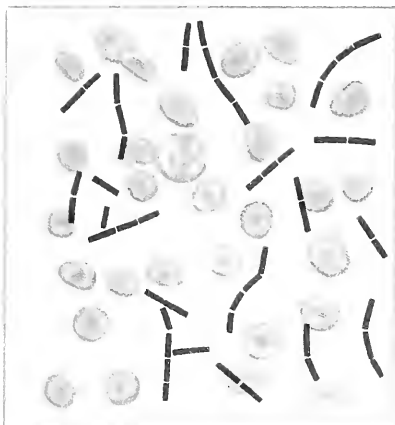


FIG. 1.—ANTHRAX BACILLI
(MAGNIFIED ABOUT 800 DIAMETERS).

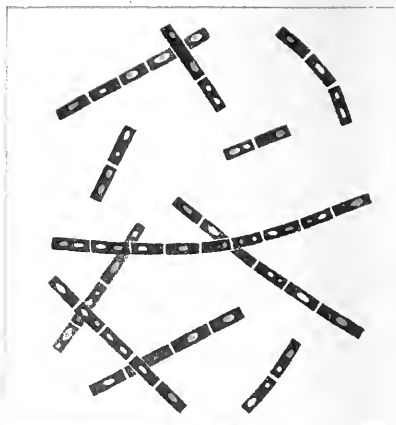


FIG. 2.—ANTHRAX SPORES
(MAGNIFIED ABOUT 1200 DIAMETERS).

COMMON APPEARANCE OF ANTHRAX ON THE SKIN:



FIG. 3.—1ST OR 2ND DAY.

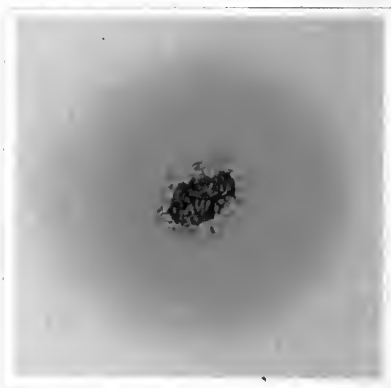


FIG. 4.—3RD OR 4TH DAY.

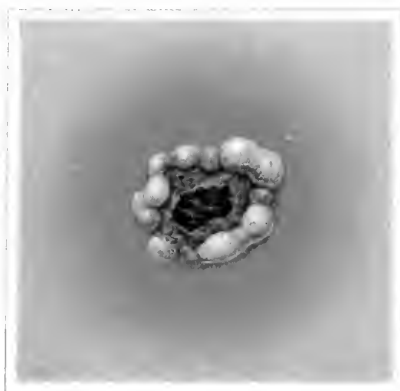


FIG. 5.—LATER STAGE.

CHAPTER II.

MEDICAL ASPECTS OF HUMAN ANTHRAX.

SYMPTOMS.

Human anthrax is caused by the entrance into the body of anthrax bacilli or spores, and by their rapid development and multiplication in the favorable media there encountered. In a majority of cases inoculation takes place through a scratch or cut in the skin; in such case external anthrax results. This can be of two kinds, (1) malignant pustule, (2) malignant edema or erysipelatous anthrax. More rarely the germs are inhaled and infect the respiratory organs, or enter with food into the digestive tract; this is the origin of internal anthrax, with its two forms, (1) pulmonary and (2) gastrointestinal.

Many exaggerated ideas of the deadliness of the disease have been current,¹ but it is now known that the vast majority of cases end in recovery. Rebentisch² describes the main symptoms of malignant pustule as follows: The disease begins with a red pimple of the size of a pin's head, formed at the point of inoculation. As there is hardly any pain, very little attention is paid by the patient to the disease in this stage. The pimple rapidly increases in size. It becomes surrounded by a peculiar, resilient swelling, often of considerable extent, the so-called anthrax edema. In the center of the pustule there is a black spot around which the skin rises in blisters, this black spot having given to the disease its French name of charbon. The appearance of the affected place is very characteristic and makes a lasting impression on anyone who sees it. On the third or fourth day the lymphatic glands in the vicinity of the pustule are usually swollen and painful. In cases where the pustule is situated in the front part of the neck, the inflammation may attack the larynx and thus endanger the patient's respiration. Pustules may appear on several parts of the patient's body, but such cases are rare.³

Except for the local symptoms, slight cases are uneventful. Serious attacks are marked by fever and by accelerated heart activity. In critical cases the patient complains of weakness and pain, and

¹ An up-State New York paper in 1913 even went so far as to print the remarkable statement: "So malignant is the disease that there is no known remedy for it, infection being invariably fatal."

² *Gewerbliche Milzbrandkrankungen*, in *Zentralblatt für Gewerbehygiene*, May, 1913, pp. 202, 203.

³ See colored plate; also *Platè 2*, facing p. 18. Figs. 1 and 2 are from *Associazione degli Industriali d'Italia per prevenire gli infortuni del lavoro: Istruzioni agli operai per prevenire il Carbonechio*. Milano, 1909. Figs. 3, 4, and 5 are from Great Britain, Factory Inspector's office, Form 410, March, 1908.

delirium is not infrequent. If the bacilli penetrate into the blood stream and are not quickly overcome, the condition of the patient becomes worse and the disease takes a fatal turn. The complete cycle of the disease occupies on the average 9 or 10 days. Sometimes death occurs much sooner.

In the other form of external anthrax, malignant edema, the pustule is absent. The edema or swelling usually covers an extensive surface and is most frequently situated on the eyelid, neck, or forearm. "The local symptoms," states Bell, "are the extensive edema, in slight cases, without redness, vesication, or eschar; in severe cases, with redness, vesication, and a gangrenous appearance of the skin. There may be no pain, no distress, and no fever. Even in fatal cases these are not very marked."¹ This form of the disease occurs much less frequently than the pustule.

The internal varieties of anthrax are comparatively rare. The symptoms are not characteristic and can be easily mistaken for those of a number of other infectious diseases; this makes diagnosis very difficult and causes frequent error. According to Nebolioubov, internal anthrax is often a "surprise of the autopsy"; it is also very possible that many cases escape diagnosis.

Gastrointestinal anthrax, says Straus,² "begins quite suddenly with general weakness, pains, and shivering; this is followed by digestive troubles, vomiting, colic, distention of the stomach, diarrhea; the whole body is affected; there is difficulty in breathing, weak pulse, and cyanosis; death, most frequently in a state of collapse, but exceptionally with tetanus-like convulsions, occurs in from two to five days after the appearance of the first symptoms."

Pulmonary anthrax, more frequent than the intestinal form of the malady, is also known as woolsorter's disease. According to the authority just cited, one of its first symptoms is "extreme weakness, combined with headache and profuse perspiration; soon there appear constrictive pains in the chest, difficult breathing, and cyanosis; auscultation reveals congestion and edema in the lungs; sometimes there is delirium; the patient dies in a collapse; the disease usually lasts from 4 to 8 days, but sometimes death comes more suddenly."³

TREATMENT.

In the treatment of anthrax the resistance of the human body to bacterial infection is a factor of considerable importance. A number of physicians have tested the method of "expectant treatment," based only on the resistance of the body, and found it successful in both

¹ Anthrax—Its Relation to the Wool Industry, John Henry Bell, in *Dangerous Trades*, by Thomas Oliver, London, 1902, p. 637.

² I. Straus: *Le Charbon des Animaux et de l'Homme*, 1887, p. 203.

³ *Idem*, p. 207.

local and general affections. The prevailing tendency among medical men, however, has been toward more energetic therapeutic methods.

The kinds of treatment now most frequently used are extirpation, medicinal treatment, and serotherapy, either singly or in combination. Extirpation of the lesion by excision, when it is in an operable location, has been practiced since the eighteenth century. A variant of this method is extirpation by cautery—either actual cautery with a hot iron,¹ or cautery by means of phenol or some other corrosive acid. By some, however, including a number of very successful practitioners, the method of extirpation, especially by excision, is at present held to be unreliable and dangerous. The excision, it is said, does not always remove all the infected tissue, while the knife in opening the vesicles may facilitate the entrance of the bacteria into the circulation and thus make conditions worse.

For the medicinal treatment of anthrax, great faith was at one time placed in such supposed remedies as oak bark, lemon juice, tobacco leaves, and roast onions, but these have now been discarded in favor of more scientific applications.² For instance, one experienced American physician who in the last eight years has treated more than 42 cases affecting the cutaneous and cellular tissues thus describes his method:

The part is thoroughly but gently washed with 1:2,000 chloride of mercury solution,³ dried well, then swabbed with 10 per cent tincture of iodine and some alkali applied. This is repeated daily for several days until the slough has come away. It takes about two or three weeks for an ulcer to heal, which it does, with very little scar as compared with the tissues involved. No systemic treatment is necessary other than cleaning out the bowels, though some require strychnine and alcoholic stimulants. If the trachea becomes much involved, nothing will prevent death by suffocation. It has been my experience that if the vesicles are kept unruptured it is better for the patient. The fatal cases I have seen were those in which the vesicles had been ruptured.⁴

In some cases internal administration of certain antiseptics, chiefly iodine, is resorted to. These antiseptics can not be given in doses sufficient to destroy the bacteria, but they are effective in impeding their multiplication. Tonics and stimulants such as quinine, alcohol, wine,

¹ Successful treatment of an anthrax case by actual cautery was reported from Riverhead, N. Y., in the summer of 1916. The patient was a prosperous farmer.

² A. N. Bell, one of the first American writers on anthrax, records a case in which "a physician was called, who, thinking the disease to be erysipelas, ordered the application of 24 leeches, to be followed by a poultice of cow manure." (*Malignant Pustule in the United States*, 1862, p. 16.)

³ The danger attending the use of mercuric chloride in this manner is illustrated by an instance described by Balderston. A physician called in to a case found the patient suffering from anthrax, and around the pustules a number of punctures made by a hypodermic needle. On being asked what he had injected, the physician who first had the case in charge replied bichloride of mercury. "He was not able to say exactly how much had been given, but the man died of bichloride poisoning." (*Journal American Leather Chemists' Association*, July, 1916, p. 341.)

⁴ John Palmer, jr., in *Journal American Medical Association*, Nov. 6, 1915, p. 1670.

or coffee, as well as the inhalation of oxygen, are also reported to be beneficial.

Serotherapy, the third modern method, is as yet hardly beyond the experimental stage, but it holds out important promise for the future. It consists of the injection, usually intravenously, of fluids from an immunized animal, containing germicides or having a neutralizing effect on the germ's secretions. Several kinds of serum have been tested and found more or less effective. Perhaps the greatest success is credited to the serum produced in 1895 by Prof. Sclavo, of Siena, Italy. At first he experimented on animals, but in 1897 began to use his serum on human beings. After six years he collected the records of all cases in which his serum had been applied, and found that, out of 164 cases, only 10 had resulted fatally. This mortality rate of 6.1 per cent is very low as compared with that of 24.1 per cent which is the general rate reported by Italian statistics. The value of this serum is recognized in Italy to such an extent that in some cities workers in tanneries and hair factories demand vaccination as soon as they notice a suspicious mark on their skin.¹ Recently the manufacture of antianthrax serum has been undertaken by a well-known American firm, but even the American article is highly expensive, 80 to 100 cubic centimeters being required for the initial dose, at a cost of from \$28 to \$35. It is still too early to form a definite judgment of the value of serotherapy, but it is commended by a number of anthrax authorities, and its use is continually extending. It is, for instance, combined with excision when possible in the routine treatment for all cases of anthrax admitted into certain prominent American hospitals and into the Bradford Infirmary in England. In other anthrax centers serum is given without practicing excision and with very successful results.

No matter what mode of treatment is adopted, prompt diagnosis and rest for the affected part are stressed by leading authorities.

¹ J. Cavailé: *Le Charbon Professionnel*, p. 112.

ANTHRAX INFECTION.

PHOTOGRAPHS OF PATIENT.



PLATE 1.—BEFORE INFECTION.



PLATE 2.—MOST ACUTE STAGE OF INFECTION.

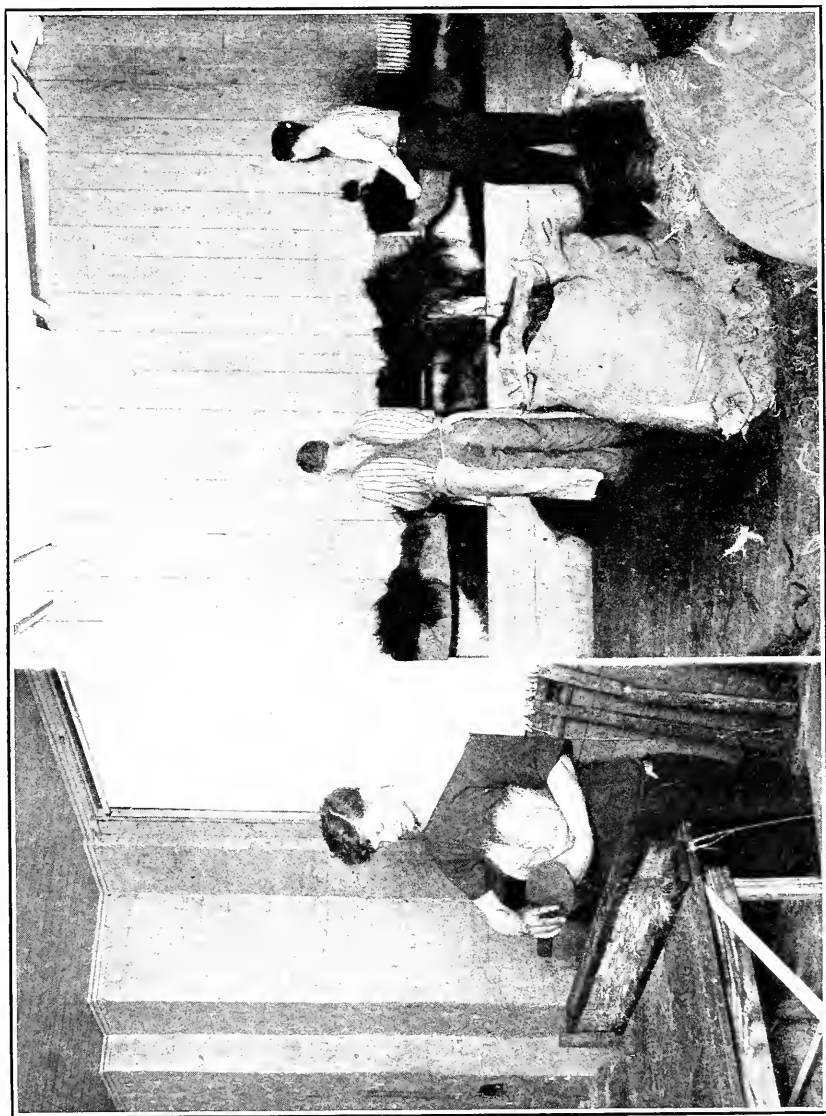


PLATE 3.—SORTING UNWASHED HORSEHAIR.
Chiefly Imported from China, Russia, and South America.

CHAPTER III.

INDUSTRIES AFFECTED.

AGRICULTURE AND OTHER INDUSTRIES INVOLVING DIRECT CONTACT WITH ANIMALS.

Anthrax in man is, in the great majority of cases, of occupational origin. In a number of occupations anthrax is transmitted to the workers directly by animals. Farm laborers, shepherds, butchers, flayers, and veterinarians, for instance, contract the infection by coming in immediate contact with the diseased animals or with their carcasses.

More numerous are the groups of persons who handle, for the purpose of manufacture, materials derived from infected animals. Such materials are used in several very important industries, including the wool industry, the manufacture of leather and leather goods, work on bristles and hair, and making artificial manure. Protection of the workers is particularly difficult in the leather industry, since reliable and practicable means of disinfection, such as exist for hair and bristles, have not yet been conclusively worked out for hides and skins.

LEATHER INDUSTRY.

No country in which the leather industry has developed to any degree of importance can depend entirely on its own supply of hides and skins. These products come in enormous quantities from less highly developed countries, where manufacturing is hardly known but where vast lands furnish favorable conditions for successful stock raising. In these regions sanitation is usually unknown or neglected, and clean materials are packed in the same bale with those which have been infected. Materials imported from China, India, and other Asiatic countries, and from some localities in Africa and South America, are considered particularly dangerous.

The hides and skins are usually imported in a raw state. Before being used in manufacture they must be subjected to the process of tanning. Upon their arrival at the tannery the skins are sorted and then soaked. This soaking brings the "dry" hides to a moist flexible state, which is necessary for a more complete absorption of the tannin from the subsequent tan liquors. All kinds of skins—"dry," "wet salted," and "green" (fresh)—are cleansed, in the "soak," from earth, blood, and dirt adhering to them and from any

preservatives with which they may previously have been treated. The "soak" may consist of fresh water or of water to which antiseptics have been added, the contents of the fluid, the time of exposure, and the details of the process varying in different establishments. This treatment, although it does not succeed in destroying the spores, nevertheless diminishes considerably the risk of anthrax infection, because it washes away the blood, dirt, and other substances containing spores. The next step is to remove the hair. For this purpose the materials are placed in pits containing a saturated solution of slaked lime, where they remain for several days, according to the class to which they belong. Even this prolonged lime bath, which is a powerful disinfectant for many purposes, is unable to kill the anthrax spores. As a result of the action of the lime the hair is easily removed with a special knife. Then, any adhering particles of flesh are scraped off; the skins are "delimed," that is, the remains of the lime are washed off; and this is followed by the steps immediately preceding tanning and by tanning itself.¹

The incidence of anthrax varies in the different processes. Reben-tisch,² as a result of his own researches and those of the German Leather Industry Accident Association, came to the conclusion that only a small number of cases occurred among workers in the departments where dry skins were manipulated, whereas the majority of victims were engaged in the processes of soaking and washing. Cavaillé, from his study of the tawing works in the city of St. Denis, France, reached a similar conclusion.³ American and British experience, however, seems to contradict this, the majority of tannery cases in both these countries occurring in the early dry processes such as unloading, storing, and sorting.

The various manufacturing processes, by additional cleaning of the skins, still further reduce the danger of anthrax, but are not capable of removing it completely. There is always the possibility of finished leather conveying the disease. In support of this theory Constant Ponder gives the following evidence collected by him from various authors:⁴ (1) Shoemakers who have handled only leather have contracted anthrax; (2) horses have contracted anthrax on the flank where a new pair of reins touched them; (3) it has been shown that the spore sometimes survives, unharmed, the processes of tanning.

ANIMAL HAIR AND BRISTLE INDUSTRY.

Another group of industries where the danger of anthrax is present is that involving the manipulation of animal hair and bristles.

¹ See Plates 4 and 5.

² Gewerbliche Milzbrandkrankungen, in Zentralblatt für Gewerbehygiene, June, 1913, p. 249.

³ J. Cavaillé: Le Charbon Professionnel, p. 132.

⁴ Constant Ponder: A Report to the Worshipful Company of Leather Sellers on the Incidence of Anthrax among Those Engaged in the Hide, Skin, and Leather Industries, with an Inquiry into Certain Measures Aiming at Its Prevention. London, 1911, p. 17.

The hair is obtained from horses, asses, mules, and oxen; the bristles from hogs and wild boars. The hair is used for making haircloth, cords, gloves, and a number of other articles, and for stuffing pillows, mattresses, chairs, and saddles. The manufacturing countries do not depend upon their own supply of hair but import large quantities from China, Russia, South America, and other places, China supplying more bristles than any other oriental country. Of all the varieties of hair, Russian horsehair is considered the most dangerous.

The hair reaches the factory in large compressed bales weighing several hundred pounds. Upon the bales being opened the hair is sorted according to color, length, and strength.¹ Then it is either shaken on a screen or combed. This process removes the dust from the hair and separates the long hair from the short. The former method is used in weaving, the latter in brush making. To make permanent the curl in hair used for stuffing pillows, mattresses, chairs, and saddles; the hair is steamed for 15 to 20 minutes under a pressure of 1 to 2 atmospheres; other methods, such as exposure to dry heat under ordinary pressure, are also used for the purpose. After dyeing, if this takes place, the hair is rinsed, dried, and packed. Dyeing is a very welcome process as far as prevention of anthrax is concerned, because the hair is left for several hours in a solution heated by the passage of steam. The heat is never sufficient to destroy the germs, but the dirt is removed and probably the virulence of the spores is diminished; however, the hair is not often dyed.

The early processes of opening, sorting, and combing involve a greater degree of risk than the subsequent manipulation. This risk is increased by the filth and dust, both of which are notorious carriers of anthrax germs.

Bristles upon their arrival at the factory are also sorted and separated from the dirt and from all bulky foreign matter; to remove the finer particles of filth the bristles are arranged in layers, sprayed with water, and left for a time. This produces decomposition of the still adhering foreign substances, which are then easily carried away with steel combs. After that the bristles are rinsed in cold water, tied in packages, and dried. Frequently the better sorts of bristles arrive sorted and cleansed. As in the case of hair, the first operations—unpacking, sorting, and combing—are more risky than the others, and the prevalence of anthrax among the workers engaged in them has attracted considerable attention.²

WOOL INDUSTRY.

The danger of anthrax is also present to a very marked degree in the wool industry. Wool is obtained chiefly from goats, sheep,

¹ See Plate 3, facing p. 19.

² Two days after he injured his finger while at work in the factory of the New Haven Brush Co., its president, Elmer W. Griswold, died Dec. 24, 1916, of anthrax which the physicians believed was communicated to the wound from an infected bristle of a hairbrush.

and camels and is imported from some of the oriental countries, such as Asiatic Turkey, Arabia, Tibet, and Persia, also from Russia and from some localities in South America and Australia. Like hair and bristles, it frequently reaches the factory in a filthy state. Upon opening, the wool is sorted according to color and quality, after which it is freed from dust in the willowing machines, and blended so as to obtain a uniform color in bulk. Then each sort is put several times in succession through an alkaline bath at 130° F. This removes any remaining dust and dirt and dissolves the blood clots, which adhere to the wool with extreme tenacity and which, if from an animal which has suffered from anthrax, contain abundant spores. After rinsing and drying the wool is either combed or carded, according to the use for which it is designed. The processes in the wool industry, as in the industries previously described, vary in different establishments. Particularly dangerous are the early operations, since the dirt and dust are laden with germs; indeed, pulmonary anthrax owes its special title, "wool sorter's disease," to its appearance almost exclusively among workers in dusty wool processes. The liberation of the spores by the alkaline bath accounts for cases in the later processes of carding and combing.

HORN AND BONE INDUSTRY.

Among other imported animal materials utilized in industry, horns and bones are occasionally a source of infection. They are used in the manufacture of combs, buttons, knife handles, corset bones, and smoking pipes. During the breaking, cutting, and chipping, small sharp fragments are projected which wound the worker and in this way facilitate inoculation.

TRANSPORTATION.

The simple handling of infected goods during their transportation has also been shown to cause anthrax. Longshoremen, porters in warehouses, and other transportation workers frequently contract anthrax while loading or unloading infected materials. Sometimes anthrax is transmitted to these workers not through immediate contact with animal products, but indirectly. Cases are known of laborers having become infected from cargoes of corn, wheat, and barley. Apparently the grain had come in contact with infected animal products or was stored in places where such merchandise was previously kept.

Cases of anthrax also appear among workers in glue factories, rag-sorting works, felt factories, and establishments where fertilizers and artificial animal food are being prepared. The danger of infection in these occupations is comparatively slight.

NONOCCUPATIONAL ANTHRAX.

Anthrax statistics also include many cases of persons between whose occupation and the disease no connection can be traced, such as children, housewives, persons without any occupation, schoolboys, teachers, and professional men. In 1915 and 1916 several widely scattered British cases of the disease, including one death, were definitely traced to shaving brushes, manufactured by one firm from bristles of Chinese origin; a number of the suspected brushes were examined and found to contain anthrax spores which had survived the processes of manufacture.¹ This possibility of unexpected attack and the fatal consequences which may ensue, even despite energetic treatment, add greatly to the urgency of adequate measures for eradicating the menace.

¹Report of the County Medical Officer and School Medical Officer for the year 1915. London County Council, August, 1916, quoted in MONTHLY REVIEW of the U. S. Bureau of Labor Statistics, November, 1916, pp. 108-110.

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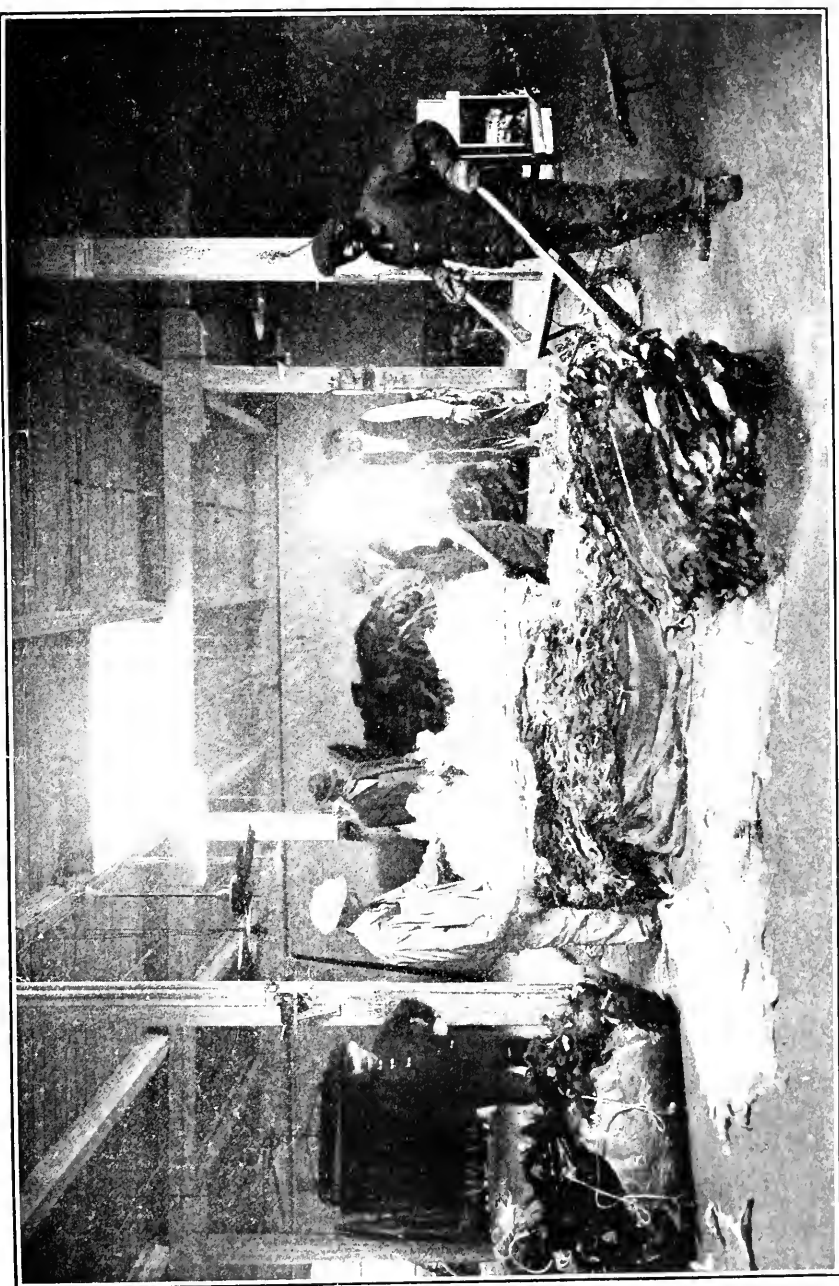


PLATE 4.—SELECTING RAW SKINS IN WAREHOUSE OF KID FACTORY.

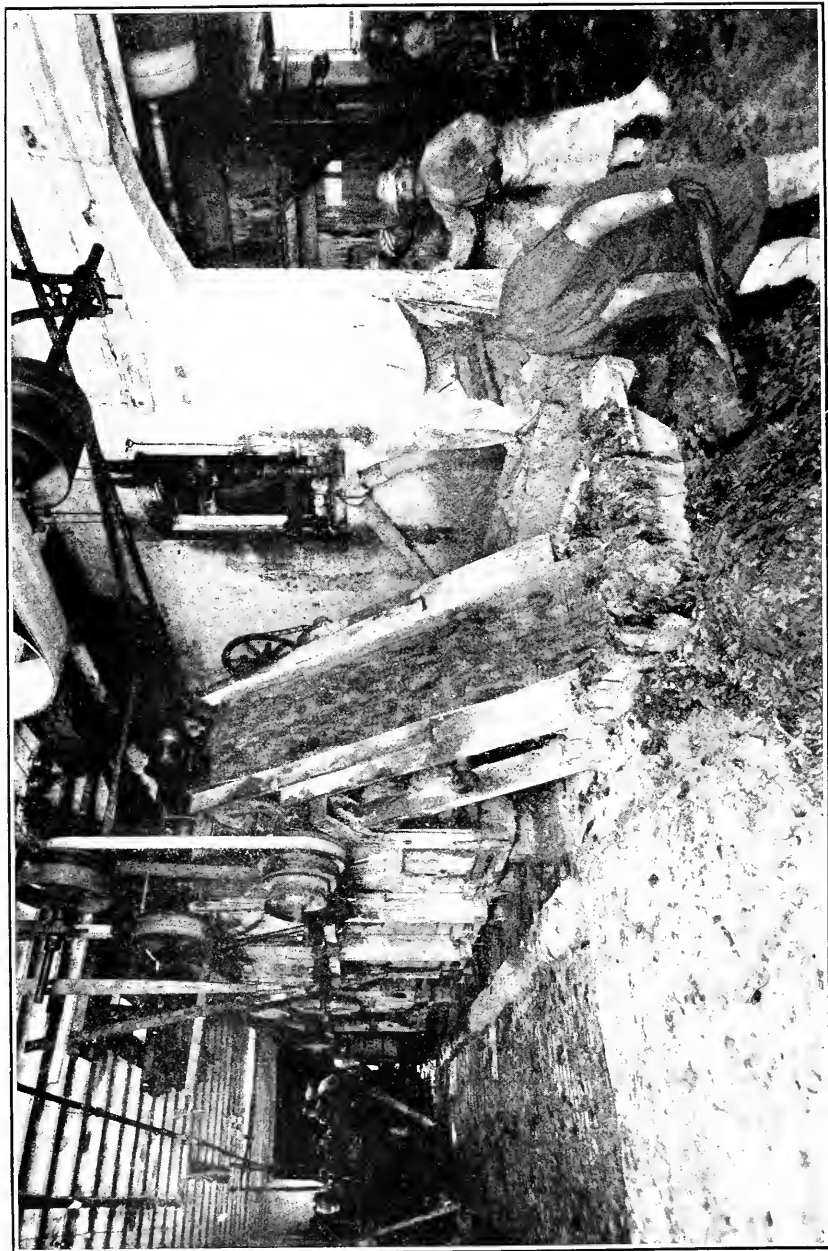


PLATE 5.—DRYING HAIR AFTER REMOVAL FROM SKINS IN A KID FACTORY.

CHAPTER IV.

ANTHRAX IN THE UNITED STATES.

The record of anthrax in the United States forms an absorbing chapter in the annals of the country's tardy but gradual movement toward the recognition and prevention of occupational disease. Practically all the industries in which anthrax occurs are to be found in this country, and cases have been known to medical men for the better part of a century. It is only in recent years, however, that industrial and community responsibility for the disease has been brought to the fore, and social activity for its control is still in the early stages.

EARLY EXPERIENCE.

Early American experience with anthrax is recorded only in occasional papers by medical men who came in contact with interesting cases, and the story thus preserved is necessarily very incomplete. Perhaps the first human cases so recorded in the United States occurred in Philadelphia in 1834.¹ An epizootic of "murrain" broke out among the cattle near that city and finally spread to the city itself, prevailing especially among cattle that fed on the common. Several persons who had been engaged in skinning animals that had died of murrain were affected with the malignant pustule. Of the three patients who were treated by the historian of the outbreak, one stated that "while he was skinning a cow dead of murrain a mosquito bit him on the back of the hand. With the other hand, which was covered with the blood of the cow, he brushed away the mosquito and rubbed the itching bite." In all three cases the infection was on the hand, and all ended in recovery. A fourth case occurred in the following year (1835). A milkman skinned a cow which had died of murrain and carried the hide on his bare arm. Several days later he noticed a pustule on his arm, from which he eventually recovered. In all these cases the symptoms of the malignant pustule in man were well characterized.

By 1835, also, large numbers of human cases had occurred in Louisiana. Eight of these were described by one physician,² who traced

¹ C. W. Pennock : On the Malignant Pustule ; With Cases, in *American Journal of Medical Science*, Vol. XIX, November, 1836, pp. 13-25.

² William M. Carpenter : A Treatise on Malignant Pustule. Thesis submitted to the faculty of the Medical College of Louisiana, 1836 ; also *Southern Medical Journal*, February, 1839, pp. 257-274.

the history of malignant pustule in the region back to the time of its settlement by the French and believed that the disease was first noticed in America among deer feeding on the salt marshes near the mouth of the Mississippi River. Later it attacked the planters' cattle, returning annually, and by the time he wrote it was prevalent in nearly every part of the State, but "seems not to have been even noticed in the medical annals of America." During 1851 Louisiana was visited by an anthrax epidemic which was compared¹ to that described in the first book of Homer's *Iliad*:

On mules and dogs the infection first began,
And last the vengeful arrows fixed on man.

In several cases the disease was communicated to men by fly bites, and once by dressing the lesion of an infected mule. In Mississippi outbreaks of anthrax among animals occurred at intervals after 1836, the losses of cattle in 1865 and 1867 being particularly heavy.

In New England anthrax seems not to have attracted attention until a later date than in the Southern States. In 1852 detailed accounts of six cases were published by a Salem (Mass.) physician,² who stated that for some time previously he had seen a case every few years. He enumerated several occupations in which the disease occurred, but, in common with other physicians of the period, he indicated little knowledge of its nature. Seven years later four cases in New York, three of which terminated fatally, were described.³

An important addition to the literature on anthrax was made in 1862, in the report on "Malignant pustule in the United States," by A. N. Bell, a physician at the Brooklyn (N. Y.) City Hospital. In this work Bell summarizes several previous American publications on the subject and describes cases which occurred in his own practice. He states that when a fatal case of malignant pustule came up for discussion before the Kings County Medical Society in July, 1859, members declared the disease had existed in Brooklyn for only about four years. In December of the same year three other cases were reported to the society. Bell himself saw several other cases, and heard of 10 more in Brooklyn and of several in New York. He also gave the names of several physicians in the States of Maine, Massachusetts, Rhode Island, and New York who had treated cases of anthrax. Bell's experience with the disease convinced him of the value of early diagnosis, the importance of which has been proved by later authorities. "Of all the diseases that man is heir to," he states, "there is none in which an early diagnosis is more im-

¹ James H. Baldrige: Malignant Pustule, in *New Orleans Medical Journal*, September, 1851, pp. 200-204.

² A. L. Peirson: Malignant Tubercle, in *Boston Medical and Surgical Journal*, Aug. 25, 1852, pp. 75-78.

³ Buck, in *New York Journal of Medicine*, 1859.

portant than in malignant pustule. It is indeed of such moment that the lapse of a few hours or a day may entail the most deplorable consequences."

Struck by the repeated occurrence of anthrax in the vicinity of Walpole, Mass., a Massachusetts physician¹ made careful inquiry and found that in 1853 there first appeared in the town a "most singular disease, which was recognized by the attending physician as charbon, or malignant vesicle, a malady known from remote antiquity as prevailing among animals, but observed among mankind only within a comparatively recent period." The malady had been reported from that locality at irregular intervals until during a period of 17 years 26 cases had come under observation. Twenty-four of these cases occurred among hair workers, one victim was a carpenter employed in a hair factory, and the remaining case was that of the wife of one of the victims.

The difficulties in the way of diagnosing anthrax and the consequent underestimate of the real number of cases were recognized at a comparatively early period. "The transmission of this disease to man," said one practitioner in 1881, "is far more frequent than is generally supposed. * * * Under the names of black erysipelas, carbuncle, diphtheria, etc., many cases occur that are easily traceable to infection from animals. * * * In the last decade I have been personally cognizant of 13 cases, and four of these have occurred within the past two years in a town of 10,000 inhabitants and independently of factories working up hair or hides, which prove the most frequent sources of infection."² The author considered the problem of sufficient moment to demand sanitary legislation and "the most rigid measures for the suppression of anthrax outbreaks."

The year 1892 is considered an important date in the history of anthrax in Delaware, a State where outbreaks of the disease among both human beings and animals have been particularly frequent. In that year, according to Dr. Charles F. Dawson of the Delaware College Agricultural Experiment Station, anthrax was "officially recognized as existing in Delaware." This date seems late as compared with 1834, the year of the epidemic, previously discussed, near Philadelphia, and 1836, the date of the earliest reported outbreak in Mississippi. However, Dr. Dawson admits that "while anthrax has been known to exist in the State only since 1892, it is highly probable that the first cases occurred much earlier

¹ Arthur H. Nichols: On the Occurrence of Charbon, or Malignant Vesicle, in Massachusetts. Massachusetts Board of Health, Annual Report, 1872.

² James Law: Glanders and Anthrax, in *Cyclopedia of Practical Medicine* (supp.), New York, 1881, p. 202.

and that the disease is as old as the morocco industry.”¹ In the outbreak of 1892, when the officials were admittedly “inexperienced in the management of this disease,” several farmers contracted pustules. Since that year outbreaks of anthrax have been common in Delaware. “Estimates made by veterinarians practicing in the State show from 175 to 200 farms in Delaware that are permanently infected with anthrax. * * * The infected territory comprises about one-third of the total area of the State.”

Information on the prevalence of anthrax in the southern and southwestern parts of the country is comparatively limited. In 1894 an epidemic of anthrax was reported near Como, La., where live stock perished in large numbers and many people contracted the disease, in some instances with fatal results. In the same year a California medical man² stated that in Ventura County, Cal., alone, over 100 cases of malignant pustule had occurred between the time of its first recognition and the date of his article, and he suggested that some cases had escaped diagnosis.

A remarkable case is recorded by Dr. W. P. McIntosh, of the United States Marine Hospital Service, as having occurred at Boston. Eighteen months before falling ill the patient worked on a tramp steamer which carried hides from a South American port; since that time he had been employed on ordinary seagoing vessels. “The most probable exposure was at the time when the man was employed on the vessel transporting hides from South America. This, however, would presuppose that he had carried the infective agent about with him as part of his personal baggage for a period of 18 months. This is not inconsistent with the life history of the anthrax bacillus.”³

The difficulties encountered by early physicians in the diagnosis of anthrax are well described by Nammack.⁴ One patient, a young fruit handler in New York City, felt a slight pricking or burning sensation in the right eyebrow and upper eyelid; on the following day the lid became swollen. A surgeon was consulted and ordered a lotion. Next morning the patient went to an eye clinic, where he was told that there was nothing wrong with his eye, but that he had cellulitis of the lid; he was referred to the surgical class and again given a lotion. A day later he called at Nammack's office. The lid then presented the appearance of phlegmonous cellulitis, and the doctor prescribed hot boric acid lotions and ordered him to return next day for incision. The next morning a messenger called to say

¹ Bul. No. 90, Delaware College Agricultural Experiment Station, 1910. Anthrax, p. 17. The manufacture of morocco leather from imported goatskins was established on a small scale in Wilmington, Del., as early as 1840.

² C. L. Bard, in *Southern California Practitioner*, 1894, p. 121.

³ W. P. McIntosh, in *Medicine*, 1897, Vol. III, pp. 459-461.

⁴ Charles E. Nammack: *A Case of Anthrax; Excision; Recovery*, in *New York Medical Journal*, 1897, Vol. LXVI, pp. 78-80.

that the patient was delirious and that during the night a black pimple had developed on the eyelid. He was immediately conveyed to a hospital where the area surrounding the "charbon" was excised, cauterized, swabbed out with pure carbolic acid, and then inoculated with cultures of the bacillus pyocyanicus. Portions of the excised tissue were sent to three laboratories and anthrax bacilli were reported. "Three observers had treated the case as one of ordinary phlegmonous cellulitis." The probable mode of infection in this case was very unusual. In most of the cases which Nammack had previously seen the men had been handling hides. This patient was repacking fruit sent to a commission house. Some of the fruit came from Spain in crates which were bound with strips of rawhide. As he cut these strips one would occasionally fly up and hit him in the face. It is probable, says the writer, that in this way the skin was bruised and a way was opened for the entrance of the microbe.

During the closing five years of the last century, accounts of anthrax became very frequent. In 1896 the fatal case occurred of a Philadelphia brush maker, who had been working on hogs' bristles and horsehair imported from Siberia and from the southern part of European Russia.¹ The existence of the disease was proved bacteriologically.

The next year five cases (four fatal) occurred among the operatives of a Falls Creek, Pa., tannery. Hides imported from Asia and infected with anthrax were found to be the source of contagion.² The death of a porter in a Boston leather warehouse was described in 1898.³ This man had been carrying hides on his shoulders. One morning while shaving he noticed a small "pimple" on his neck. He continued his work on that and on the following day, but was taken ill the day after and went to the hospital, where the pustule was excised; he died a day later. Smears from the vesicles surrounding the pustule showed abundant bacilli.

Another fatal case of a hide handler was reported the same year from New Orleans.⁴ The patient had been employed in one of the largest hide stores in the city. When he was brought to the hospital the two physicians who saw him concurred in diagnosing the disease as anthrax. Antistreptococcic serum was injected, but the patient died on the tenth day of his illness. In his account of the case Dr. Dabney comments on the "scant precautions which the dealers in hides and wool in this country take for the protection of their employees against this disease." Dabney, like several other writers, is

¹ M. B. Miller: A Case of Anthrax, in Philadelphia Medical Journal, 1898, Vol. I, pp. 340-342.

² Medical News, January, 1897.

³ Abner Post, in Medical and Surgical Reports of the Boston City Hospital, 1898, pp. 226-232.

⁴ T. S. Dabney: A Case of Anthrax (Charbon), in New Orleans Medical and Surgical Journal, 1898-99, Vol. LI, pp. 377-383.

convinced that many anthrax cases remain unrecognized. "I can not believe," he says, "that malignant pustule is as rare as our hospital and board of health reports would lead us to infer. A rather careful look through the incomplete reports of the Charity Hospital from 1875 to 1897 fails to find a single case treated in that institution. * * * We are forced to the conclusion that many cases of anthrax must have died in private practice as well as in our public institutions, under the diagnosis of erysipelas, cellulitis, carbuncle (ordinary), blood poisoning, etc."

Anthrax, however, is by no means confined to the East and South. In Wisconsin, which is an important tanning center as well as an agricultural and stock-raising State, an epizootic of anthrax occurred during July and August of 1899 among the cattle in a certain district. Not less than five persons contracted the disease through skinning animals; in all these cases the pustules were on the exposed parts of the body. Investigation by the health authorities led to the conclusion that the cases among animals were produced by drinking water from a river into which the tannery waste was discharged and by grazing on meadows adjoining this river.¹ In the same summer an outbreak of anthrax occurred among tannery workers in another part of the State.

In a Philadelphia case² in 1900 the patient was a "card stopper" in a large woolen mill. The illness began when he sustained a punctured wound on his forearm while at work. Eight days later he was admitted to the hospital; the arm was dressed with a solution of bichloride of mercury, 1 to 10,000, and kept wet constantly. Next day 1 dram of 10 per cent carbolic acid was injected; on the day after, 1 dram of pure carbolic acid was used. A similar injection was made daily during each of the five following days. A week after admission the patient was up.

Lewald³ describes a rapidly fatal case of anthrax in a New York stevedore in 1902. The man had been unloading hides, and was admitted to the erysipelas pavilion of Bellevue Hospital on March 1. Three days previously he had noticed a small pimple on his neck; 24 hours after that he was ill and unable to work. Upon his admission to the hospital he continued to grow worse and died on the following day. "A smear was made from the wound a few hours before death, and the examination made at the laboratory confirmed

¹ In November, 1916, an anthrax outbreak occurred among the cattle of farmers owning grass lands along the Johns River, N. H., who fed their live stock hay cut from these lands. According to the State department of agriculture, the trouble seemed to arise from a tannery which emptied its waste into the river. A State veterinarian contracted the disease while making a post-mortem examination, but recovered. See also pp. 13 and 88.

² E. W. Fisher: A Case of Anthrax Successfully Treated by Local Injection of Pure Carbolic Acid, in *Therapeutic Gazette*, Detroit, 1900, 3s., Vol. XVI, pp. 508-510.

³ L. F. Lewald: A Case of Anthrax, in *Proceedings of the New York Pathological Society*, February and March, 1902, pp. 24-26.

the diagnosis of anthrax." In the discussion on the case the opinion was expressed that anthrax is more frequent in New York City than was commonly supposed. "Within the last three or four years, four or five cases have come into the dispensary of the Hudson Street Hospital. Singularly good results have been obtained from early radical excision."

In 1905 Drs. G. J. Schwartz and B. F. Rayer,¹ both of Philadelphia, described to the Academy of Surgery of that city a case of anthrax in a farmer, who contracted the illness through skinning a cow. In the pustule which formed on the wrist anthrax bacilli were found. The pustule was excised and the patient recovered after an illness of 35 days. In their report of the case the authors make the following comment on the lack of serum in this country: "From data presented by Legge * * * and Sclavo, it would appear that the time had come when we in this country should have a supply of anti-anthrax serum kept by health boards or research laboratories, where it might be gotten in a few hours by those called upon to treat anthrax." When the patient came to the hospital requests for serum were sent to two private laboratories, to the Marine Hospital Laboratory, and to the Bureau of Health of New York, but no serum could be found.²

Early cases of human anthrax were frequent also in several other States, including Texas. In that important stock-raising State outbreaks among domestic animals occurred repeatedly, with consequent infection of human beings. A young woman, for instance, was bitten in the face by an insect while anthrax was raging among the cattle in the neighborhood.³ She died two days after admission to a hospital. Another Texas victim was a dairyman who contracted the internal form of the disease from a cow and died on the eighteenth day.³

During the first decade of the present century five States passed laws for the reporting of anthrax, among other infectious diseases. These States are Massachusetts and Illinois (1907), Pennsylvania and California (1909), and New York (1910). In Massachusetts between August 1, 1907, and the end of 1909 nine cases were reported, seven of which occurred in Lynn, an important center of the leather and shoe industry. The fatal cases recorded are somewhat more numerous. Between 1865 and 1906, for example, a period of 41 years, 128 deaths from anthrax were recorded in Massachusetts alone.⁴ The United States registration area in 1900, the first year for which deaths from anthrax were listed separately, included only 40.5 per cent of the country's population, and in 1909 had increased only enough to cover 56.1 per cent of the population. Yet, in this re-

¹ Transactions of Philadelphia Academy of Surgery, 1905, p. 76.

² A few years later the Philadelphia Municipal Hospital and at least one progressive manufacturer began to keep Sclavo's serum.

³ H. A. Barr: Report of Two Fatal Cases of Anthrax, in Texas Medical News, 1905-6, Vol. XV, pp. 277-281.

⁴ U. S. Public Health Reports, Dec. 15, 1916, p. 3399.

stricted area 227 fatal cases of anthrax were recorded for the 10-year period. Deaths from this disease have steadily increased in number.

RECENT EXPERIENCE.

EXPERIENCE OF A LEADING MOROCCO-LEATHER CENTER.

A Delaware city, for two generations the center of the morocco-leather industry in this country, furnished a favorable opportunity for a community study of occupational anthrax. Most of the imported goatskins come dry in immense burlap-covered bales, weighing often more than 1,000 pounds each, from goat-eating countries, including China, India, Arabia, North Africa, Brazil and other parts of South America, Mexico, Spain, Macedonia, and Russia.¹ These untanned skins formerly came by steamer to New York, presumably under United States consular certificate to the effect that the foreign agents of this Government "have not required disinfection under quarantine regulations because the shippers have declared that anthrax, rinderpest, and foot-and-mouth disease do not prevail in the districts in which the skins originate."² The usual practice has been to reship the skins, by smaller boats, from New York to Philadelphia and then again, sometimes by still smaller vessels, to the Delaware city. Cargoes are now frequently shipped by train from New York, and recently the urgent demand has resulted in some railroad shipments direct from the Pacific coast.

Upon arrival at the company's warehouse the skins are unloaded, sorted, and hauled as needed to the factory, where they are dumped into tanks of water to soak for 24 hours. When softened they are drawn out and churned in large drums which separate from the skins the most easily dislodged particles of waste matter. Next they are thrown into a second series of vats and immersed for two weeks in a solution of lime and arsenic or other agents which loosen the hair. These, the preliminary processes of handling and preparing the skins, menace the worker with the greatest danger of infection because the anthrax bacilli and spores have not yet been reduced in number or virulence by the later tanning processes. On the contrary, each process preceding that of liming is well adapted to cause the anthrax germ to flourish.

At other tanneries the especially dangerous preliminary processes are similar to those just described, differing principally with the kind of skins or hides to be manufactured into leather. The tanners regard the danger as slight after the pelts have passed through the liming process. That the danger, though in diminished degree, continues through later processes is indicated by occasional outbreaks of the infection among the beamers, fleshers, and splitters. The story is told of an engineer who came from another city to install a new

¹ As a by-product one company sells in this country about \$200,000 worth of goat hair yearly to be made into blankets or carpets according to grade. This spreads danger of infection to other establishments and to other communities.

² Copied in April, 1916, from a consular certificate from Hankow, China.

mechanical device in a Delaware morocco factory and who contracted anthrax when he bruised his hand while working among scraps of waste material on the floor beneath the old machine. But in this Delaware city, as among tanneries elsewhere considered in this report, most of the cases of anthrax have occurred among the handlers and sorters of imported dry skins in the receiving warehouses.

One physician in this morocco-leather center, who has in recent years been most frequently called upon by the manufacturers to treat victims of the dread disease, furnished to the investigator the names and descriptions of 48 cases of human anthrax treated in his practice during the past six years. All but half a dozen of these were from the receiving warehouse of one morocco-leather factory. This physician reports that only three of his cases resulted fatally.¹ The infection in the majority of cases was on the face or neck. In a few cases it was on the shoulder, arm, hand, abdomen, or thigh. One patient reinfected himself from the back of his neck to his cheek. Another suffered two attacks, first on the neck and then, nine months later, on the arm. In no instance was the disease contracted from a previously existing case in a human subject.

Other physicians interviewed gave meager accounts of their anthrax experiences, speaking largely from memory, aided as to names and dates by their cash accounts with leather manufacturers. All referred to a local company physician, now several years deceased, as having treated the greatest number of cases of anthrax. According to his widow, who had acted as his drug clerk and was familiar with his practice for 20 years, he often had as many as four or five such cases at a time.

Local hospitals, on the plea that they are "not equipped," refuse to receive anthrax patients, although a nurse in charge of a private institution cared for two or three such patients several years ago, and one of these, a serious case, is reported to have been sent to the hospital by a physician under the mistaken impression that the workman was suffering with erysipelas.² One untrained woman told the investigator that she had nursed four cases, including her own son, in a room of her boarding house, much to the consternation of the other lodgers, whose fear of the disease made them reluctant to pass through the sick room on their way to their own bedchambers.³

¹ For methods of treatment followed by this experienced physician and by others in the same city, see p. 17.

² The refusal of hospitals to admit cases of anthrax seems not to be confined to Delaware. R. L. Moore, of Elkland, Pa., states: "In one case which proved fatal the physician in charge was away, and a long automobile ride was necessary to reach the nearest hospital. On being refused admission there, the patient was taken on an all-night trip to the nearest physician who was acquainted with the disease. Although he was in fair condition, it was too late to save the patient." (Journal American Leather Chemists' Association, July, 1916, p. 342.)

³ The ghastly appearance of some of the anthrax patients, with heads swollen until their features practically disappear, is terrifying to their friends and leaves an impression not quickly forgotten.

This untrained nurse, whose personal dread of the disease led her to don gloves and a mask, was of the greatest assistance to the physician in bringing back to health these patients, one of whom suffered two attacks within a year. "I ran the additional risk of losing my boarders and lodgers," said this woman, "but the hospitals wouldn't take anthrax patients. What else could I do?"

Conversations with morocco workers' families brought out the fact that fear of this disease was common, and this fact probably influenced the State board of health in issuing strict orders, which went into effect April 1, 1915, placing anthrax on the list of infectious diseases to be quarantined. The quarantine placards, printed by the State and posted by the city health officials, read as follows:

This notice must be tacked on the front door.

ANTHRAX.

Until this notice is legally removed all persons not occupants of these premises are forbidden to enter, and no person must leave this house or remove any article except by permission of the health authorities.

It is also required that every house in which a case of anthrax has occurred or exists shall be "completely disinfected" upon the recovery, death, or removal from such house of the patient. Quarantine shall be continued for 14 days after disinfection.

At the work places precautions against infection from materials handled are not elaborate. At only one warehouse was a warning notice found posted. It was in two languages and read as follows:

NOTICE TO EMPLOYEES.

Use soap, water, flesh brush, and towels liberally.

Rinse your hands in bucket of disinfectant before drying on towels.

Give special attention to finger nails, always keep them short and clean.

Do not scratch or pick any broken surface of the skin.

Report to office any form of sickness, cuts, accidents, bruises, pimples, or sores, for immediate attention.

See that dressing rooms, washbasins, and toilets are kept clean, and report to foreman any violation of above rules, for your own protection.

Caution all new employees.

Working gloves may be obtained at office.

Universal was the testimony that the workers paid little or no attention to written or verbal warnings except as the foreman or superintendent with watchful eye detected an abrasion of the skin or a suspicious looking "pimple" and personally required the use of a disinfectant. It was commonly stated that in conformity with the requirements of the local health officials a supply of bichloride of mercury was constantly kept in readiness for disinfecting purposes. At three of the warehouses visited, special inquiry was made for the disinfectant, and in two cases bottles of bichloride of mercury tablets were shown at the office, once, however, with the bottle unopened and thickly covered with dust, while at the third warehouse the foreman, with some embarrassment and after a perfunctory search, remarked that he believed the tablets had been borrowed by the factory in the next block. In the same warehouse there was one sink with a single faucet and one piece of soap for the ablutionary convenience of the workmen, but it was admitted that no warm water was available even in winter. "The men all wear gloves at their work," said the foreman. Careful inspection half an hour later, however, disclosed six out of eight skin sorters and truckers in a near-by corner working with hands unprotected. "Well, they wear gloves in the winter," was the foreman's amendment.

Very general was the opinion among physicians and laymen that hides and skins imported from districts where anthrax is prevalent should be disinfected before they are landed in this country. One official of a tannery company, however, complained that the Federal Government, during the preceding week, had required them to disinfect 700 hides, at a cost of \$120, because the hides had come through without a consular certificate from the country of shipment to the effect that certain diseases, including anthrax, were not prevalent at the time.

CASES REPORTED UNDER NEW YORK OCCUPATIONAL DISEASE REPORTING LAW.

The New York occupational disease reporting law¹ went into effect on September 1, 1911, and between that date and March 31, 1916, 23 cases of anthrax, 13 of which were fatal,² were reported to the State department of labor. Nearly twice as many of the total number of cases (15 out of 23) and three times as many of the fatal cases (10 out of 13) occurred in the last 12 months as during the entire preceding period of 43 months since the law became operative. This increase is probably due in part to more active compliance of physicians with the law, but as it coincides with large increases in

¹ New York, Laws of 1911, ch. 258.

² For detailed accounts of 12 of these cases which occurred prior to 1916, see pp. 60 to 78.

the number of cases treated by hospitals in other States, as will later be shown, there can be little doubt that it is, in the main, indicative of a real and startling growth in the prevalence of the disease. Eight of the cases were reported from New York City, including Brooklyn; four from Gloversville, the center of the American glove industry; four from Endicott, where there are large tanneries and shoe shops; and one from each of seven other cities and towns. Twenty of the patients were males, while three were females. Half of them were between the ages of 41 and 60; the youngest was a little girl of 6; the oldest a retired lawyer of 71.

The occupational group most largely represented was the hide, skin, and leather workers, of whom there were 10 (4 of whom died), including 6 employees of hide tanneries, 3 workers on sheepskins, and 1 shoemaker. The shoemaker was employed in a large factory and may have contracted the disease from an infected hide in which the spores had survived the tanning processes.¹ The workers on sheepskins are described, respectively, as "washer of sheepskins," "trimming sheepskins," and "limer and general helper," who had, however, just before infection, been "helping store away raw sheepskins." Among the hide-tannery employees were one beam hand, two who apparently worked in a freight gang conveying green hides to one tannery only, two whose exact occupation was not stated, and—worthy of special note—one steam fitter. A second occupational group was the transportation workers, represented by three cases (two fatal). One was a dock laborer, one a baggage-master on a dock, and one a driver. There were three farmers (two of whom died), and one from each of the following callings: "Laborer in skin mill—drying sheep wool," spinner in rug mill, veterinarian, candy packer, and lawyer; two were not engaged in industry. There were, therefore, at least seven persons, and possibly nine, who became infected through the transportation and early treatment of hides and skins before actual tanning was begun. The rug-mill employee had a pustule on the thumb "following scratch from piece of tin on floor of spinning room"; anthrax bacilli were found. The veterinarian was infected while vaccinating cows, suffering from anthrax, on three up-State farms. One farmer, who died, is believed to have caught the disease from a sick cow which he slaughtered and dressed for beef.²

¹ See p. 20.

² See fatal case No. 78, p. 71.

TABLE 1.—CASES OF ANTHRAX REPORTED TO THE NEW YORK STATE DEPARTMENT OF LABOR UNDER THE OCCUPATIONAL DISEASE REPORTING LAW, SEPTEMBER, 1911, TO MARCH, 1916.

Occupation.	September to December, 1911.		1912		1913		1914		1915		January to March, 1916.		Total.	
	Cases reported.	Fatal cases.	Cases reported.	Fatal cases.	Cases reported.	Fatal cases.	Cases reported.	Fatal cases.	Cases reported.	Fatal cases.	Cases reported.	Fatal cases.	Cases reported.	Fatal cases.
Hide, skin, and leather workers.....	1	.....	.....	.....	1	1	1	1	4	2	3	.....	10	4
Transportation workers.....	1	.....	.....	.....	.....	.....	.....	.....	2	2	.....	.....	3	2
Farmers.....	.....	.....	.....	.....	1	1	.....	.....	2	1	.....	.....	3	2
Veterinarians.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	1	.....
Miscellaneous.....	.....	.....	1	.....	.....	.....	.....	.....	2	2	1	1	4	3
Not in industry.....	.....	.....	.....	.....	.....	.....	.....	.....	2	2	.....	.....	2	2
Total....	2	.....	1	.....	3	2	1	1	12	9	4	1	23	13

None of the cases is specified as having been internal. Eight of the lesions were on the face, four on the neck, three on the hand, two on the arm, two on the chest, two on the hip, one on the leg, and one not stated. In eight cases anthrax bacilli were actually found, either in cultures from blood serum or by post-mortem examination of the organs, and six of the cases in which bacilli were found resulted fatally. On two patients antianthrax serum was used; one of these recovered.¹

The result of applications filed in certain of these cases for indemnity under the New York workmen's compensation law is taken up on p. 92.

CASES REPORTED UNDER NEW JERSEY OCCUPATIONAL DISEASE REPORTING LAW.

The law requiring the reporting of occupational diseases in New Jersey² was passed a year later than the New York statute, the results of which have just been described, and went into effect on July 4, 1912. The State board of health, to whom reports are to be sent, states that from that date to May 1, 1916, it received 13 certificates regarding cases of anthrax, all but one of which arose in the city of Camden, the seat of extensive leather, kid, and morocco works. The remaining patient was a feed merchant in a small town, whose infection, his physician thinks, may have been "due to carrying bags of feed on shoulder."

¹ In addition to the 23 cases here discussed, reports of human anthrax in New York State have been obtained from reliable sources, as follows: 1911—New York City, assorter and packer of ready-made clothing, aged 30, treated at hospital; recovered. 1915—New York City, Government weigher handling hides, aged 34, died; New York City, medical student, aged 25, died; Saratoga Springs, farmer, contracted disease by performing autopsy on cow, outcome not learned. 1916—New York City, hide handler, employed by importer, aged 39, treated at hospital, recovered; New York City, fruit company employee, aged 16, died; Endicott, tannery laborer, handling dry hides, recovered; Utica, cattle dealer and butcher, outcome not learned. Further details of the two fatalities in 1915 will be found on pp. 75 and 78.

² New Jersey, Laws of 1912, ch. 351.

Only one of the 13 cases was fatal—that of a receiver and checker of Russian horsehides. All the patients were men ranging from 21 to 55 years of age; 7, or more than half of the total number, were between the ages of 21 and 30. Four of the lesions were on the neck, two were on the face, and two were on the arm. "Infected part resembled a typical vaccination, except black," says the physician of one of these. In another case the form of the disease is stated as external, but the location is not given; in the remaining four cases the form is not stated, but since the patients recovered it was probably external in these also. In only one case is the finding of anthrax bacilli reported; 100 c. c. of antianthrax serum were used, and recovery followed. Three other patients who recovered were also treated with serum, one being given 10 c. c. and another "about eight injections," while the third "had 20 injections of antianthrax serum, 200 c. c."

The occupations are known for nine of the patients in addition to the feed merchant, and all but one of these were in contact with hides and skins. Three were engaged at the same leather works, one as a "checker and receiver of incoming horsehides" imported from Russia, one as a "stock assorter, examining hides and skins," and the third at "assorting and handling hides." Of three men employed in a single kid shop two are designated only as kid or morocco workers, while one was a wool washer. A patient from another kid plant handled wet raw skins, while a stationary fireman in still another factory of this class contracted the disease after acting for the "last few months as sorter of raw hides from Mexico and Central America." The ninth man of this group was a teamster, and had helped load trucks with Russian sheepskin. Thus, at least six of these men were infected by raw skins during their transportation to and receiving and sorting at the tanneries.¹

CASES REPORTED UNDER PENNSYLVANIA INFECTIOUS DISEASE REPORTING LAW.

In Pennsylvania under the infectious disease reporting law 49 cases of anthrax were reported in the three years between January 1, 1913, and January 1, 1916. Eight of the sufferers, including two hair sorters and a tannery hand, were females. Nearly one-half of the cases, or 23, occurred in 1913, and 10 of these were in the city of Philadelphia, one of the centers of the glazed-kid industry. All of the six cases reported in the first half of 1914 also came from Philadelphia, thus making for that city a total of 16 cases in 18 months.

¹ Additional anthrax cases reported to the New Jersey department of health under the preventable disease notification law (Laws of 1911, ch. 381) are: 1912—Camden, occupation not given, recovered; Camden, handler of imported hides, recovered; place and occupation not given, recovered; place and occupation not given, died. 1914—Camden, occupation not given, recovered; two cases, place and occupation not given, died. 1915—Two cases, place and occupation not given, died. Record has also been secured of a tannery worker who recovered under serum treatment at a Newark hospital early in 1916.

Here, as in the two States whose experience with anthrax under occupational disease reporting laws has been described, the occupational group most largely represented is hide and skin workers. Five were given as tannery employees, two as leather workers, one as a raw hide sorter, and one as a skin washer. Most of the 12 classed as laborers were also, it is reported, employed by tanneries. There were eight hair workers, of whom one was a haircloth examiner, two were sorters, and one a brush maker; a ninth case is given as "a car builder who might be included as a hair worker." There were two longshoremen, and one from each of the following callings: Wool handler, "raw stock" inspector (without designation of the kind of stock), liveryman, teamster, merchant, carpenter, and roofer. Two were infants 1 year and 10 months old, respectively, the father of one being a tanner and of the other a coal miner. In eight cases the occupation is not stated.

At least 7 of the 27 cases reported during the first 18 months are known to have been fatal, and are discussed more in detail in the section on anthrax fatalities reported in the United States registration area. A number of the nonfatal cases were treated in a Philadelphia hospital and are considered, together with other cases at the same hospital, in the next section.

CASES ON RECORD IN A PHILADELPHIA HOSPITAL.

One Philadelphia contagious-disease hospital reports a total of 32 cases (6 fatal) from January 1, 1909, to April 30, 1916. The great majority of the patients in these cases were men, only three—a hair sorter, a hair twister, and one other hair worker—being women; all of the six deaths occurred among men. The patients were all residents of Philadelphia. Their prevailing age was markedly lower than that of the cases reported in New York State, 12 of them being between the ages of 31 and 40, and 10 between 21 and 30; the youngest was a woman hair sorter aged 19, and the oldest a haircloth inspector of 67. The distribution of these cases by years and by occupations was as follows:

TABLE 2.—CASES OF ANTHRAX RECORDED BY A PHILADELPHIA HOSPITAL, JAN. 1, 1909, TO APR. 30, 1916.

Occupation.	1909 to 1911		1912		1913		1914		1915		Jan. 1 to Apr. 30, 1916		Total.	
	Cases re-reported.	Fatal cases.	Cases re-reported.	Fatal cases.	Cases re-reported.	Fatal cases.	Cases re-reported.	Fatal cases.	Cases re-reported.	Fatal cases.	Cases re-reported.	Fatal cases.	Cases re-reported.	Fatal cases.
Hide and skin workers	2	.....	3	1	1	.....	3	1	.....	.....	1	1	10	3
Wool and hair workers	3	.....	4	.....	5	1	.....	.....	2	.....	3	2	17	3
Longshoremen	1	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	2	.....
Miscellaneous	1	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	2	.....
Occupation not reported.	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....
Total...	8	.....	7	1	6	1	4	1	3	.....	4	3	32	6

It will be noticed that the rate of one case per month with which 1916 began is nearly double the next highest rate, that for 1912, during which year seven cases were recorded. The increase in fatal cases is still more striking, as many having occurred in the first four months of 1916 as in all the preceding seven years.¹

The largest number of patients were workers in wool or hair, due no doubt to the local prominence of this industry. Seventeen, three of whom died, were in this group, which covered a particularly wide range of processes. Thus there were four hair sorters,² one wool sorter, one hair picker, one hair twister, three hair spinners, one wool teamster, and four laborers in wool or hair plants (duties not differentiated); even men comparatively remote from danger contracted the infection, as witness a haircloth-loom fixer and a haircloth inspector. One of the hair sorters worked in a horsehair factory; the hair picker and at least one of the hair spinners were employed in a single curled-hair plant. The group next most largely represented is that of the hide and skin workers, of whom there were 10 (three of whom died). One was a hide sorter, one a hide washer, and one a sorter of raw stock in a glazed-kid factory, while the precise process carried on by seven tannery workers is not given. Two sufferers from the disease were longshoremen, and in both cases the hospital records state that for some days previous to the attack the men had been unloading hides. Of the two classified in the table as "miscellaneous," one was a shoddy worker who may easily have contracted anthrax from the dirty rags he handled; the other was a glue-factory hand who may have got it from hoofs or other parts of a diseased animal, although the hospital record further states that he "occasionally handled leather." In only one case among this valuable set of records is the occupation not stated. Throughout, the connection between occupation and contagion is much closer than in the New York series.

In all of the cases recorded by this hospital the disease took the external form. The pustule occurred in 19 cases on the face and in 10 cases the neck, the six deaths being distributed equally between these two groups. Three lesions were on the arm, and one on the hand; one case is noted—that of a girl hair sorter—in which lesions appeared both "on jaw and wrist."

Due to the care with which these records were kept, valuable data regarding the duration of anthrax attacks are available. The six cases with the shortest duration—ranging from three to eight days

¹ On Apr. 11, 1916, Chief Medical Inspector Cairns, of Philadelphia, stated that from 10 to 12 cases of anthrax developed in Philadelphia annually and that "already, in 1916, four deaths have resulted from the malady."

² One of these, who contracted the disease in 1916, filed a claim for compensation, which was denied on the ground that infection had not taken place through a "wound or other unusual incident." (See p. 92.)

after appearance of the first symptoms—were all fatal, and these were the only cases which so resulted. The next shortest case terminated in recovery and discharge from the hospital on the seventeenth day of the disease. The most protracted illness lasted for 51 days. The duration of illness and number of cases of death were as follows:

TABLE 3.—DURATION OF ILLNESS, AND DEATHS AMONG 32 CASES OF ANTHRAX IN A PHILADELPHIA HOSPITAL.

Duration of illness.	Cases.	Deaths.
Under 1 week.....	5	5
1 week and under 2 weeks.....	1	1
2 and under 3 weeks.....	5	.....
3 and under 4 weeks.....	8	.....
4 and under 5 weeks.....	4	.....
5 and under 6 weeks.....	5	.....
6 and under 7 weeks.....	3	.....
Over 7 weeks.....	1	.....
Total.....	32	6

In the overwhelming majority of cases, 22 out of 32, treatment was by excision and serum; of these, three died. In five cases excision alone was performed, and two deaths resulted. One man was brought to the hospital moribund and neither method was applied; he died eight hours later. In four cases the mode of treatment was not reported.¹

CASES ON RECORD IN A MASSACHUSETTS HOSPITAL.

The records of one Massachusetts hospital show 35 cases of anthrax between June 27, 1881, and April 26, 1916. Of these 6 were fatal, 26 were nonfatal, and 3 patients were still in the wards at the time of the investigation. The recent increase in prevalence revealed by the New York and Pennsylvania reporting laws is here paralleled. The number admitted during the first three months and 26 days of 1916 (9 out of the 35) is thrice that admitted in 1915, and equals the number treated during the whole period 1881–1904, inclusive.² The largest number of cases from single cities came from Boston (5), Woburn (5), and Winchester (4); five other towns in the vicinity of Boston sent 2 cases each, and 11 towns 1 case each. Only 1 of the 35 patients was a woman. Fifteen were

¹ The numerous instances of death from anthrax in Philadelphia was one of the reasons given for the establishment during the summer of 1916 of the clinic for occupational diseases at the University of Pennsylvania Hospital in that city.

² The total number of cases reported in the State during the first half of 1916 was 25. "This was the severest outbreak of this disease ever recorded in Massachusetts." Twenty of the cases occurred in three tanneries and were traced to a common source, a single cargo of dried "China" hides from infected territory. (United States Public Health Reports, Dec. 15, 1916, p. 3401.)

between the ages of 21 and 30, 15 were between 31 and 50, 2 were between 61 and 70, and the remaining 3 were between 11 and 20 years of age.

Hide and skin workers made up nearly half of the total number of patients—16 out of 35. Thirteen of these were tannery workers, one was a morocco worker, one a leather worker, and one a “laborer handling raw hides.” The “leather worker” was in charge of men cutting fresh hides. Of the tannery employees two were “beamers,” who scraped hides and put them through rollers; two split hides; two others took hides from the soaking pits; three of these six were reported as handling wet hides. One man handled hides as a teamster for a tannery, one was a flesher, one is designated merely as “laborer” in a tannery; one was engaged on sheep and goat skins; in the three remaining cases no information was given beyond the word “tanner.”

Transportation workers were represented by nine cases, two fatal. Four were dock laborers; two were freight handlers, one of whom handled raw hides and wool; two were weighers of skins and hides; and one was a teamster. Five patients were employed in the wool and hair industry. Two were employed in a wool factory, one of them as a carder; in the other case the infection was so serious that it necessitated amputation of the arm at the shoulder. One was an upholsterer's helper and handled wool used for stuffing. Two days before coming to the hospital he cut his neck while shaving; infection developed on neck and chest, and four days later “patient looked as if he weighed over 200 pounds.” One was a teamster carting wool, and one was employed in a hair factory.

In addition to these workers, whose employment bears a well-defined relation to the disease, two patients were designated merely as laborers. One of these, however, was employed in a soap factory. Three weeks before he was admitted to the hospital, it is reported, a box of skins was sent by mistake to the factory, where it was opened and a skin was kicked about by a fellow workman, striking the patient in the back of the neck. Rag workers, factory girls, and machinists were also represented by one case each.

TABLE 4.—CASES OF ANTHRAX ADMITTED TO A MASSACHUSETTS HOSPITAL, JUNE 27, 1881, TO APR. 26, 1916, BY OCCUPATIONS.

Occupation.	June 27, 1881, to Dec. 31, 1911		1912		1913		1914		1915		Jan. 1 to Apr. 26, 1916		Total.	
	Cases re- ported.	Fatal cases.	Cases re- ported.	Fatal cases.	Cases re- ported.	Fatal cases.	Cases re- ported.	Fatal cases.	Cases re- ported.	Fatal cases.	Cases re- ported.	Fatal cases.	Cases re- ported.	Fatal cases.
Hide and skin workers.....	5	.....	2	.....	.....	.....	.....	.....	2	1	7	.....	16	1
Wool and hair workers.....	3	1	1	.....	.....	.....	1	.....	.....	.....	.....	.....	5	1
Transporta- tion workers	4	1	.....	.....	2	.....	.....	.....	1	.....	2	1	9	2
Miscellaneous.	5	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	2
Total...	17	4	3	.....	2	.....	1	.....	3	1	9	1	35	6

The duration of illness was short in the 6 fatal cases. One such case lasted 3 days and another 5 days; 3 patients died after an illness of 7 days each and 1 after 8 days. The shortest of the nonfatal cases lasted 10 days; in another the patient was ill 13 days; 6 lasted between 14 and 21 days; in 9 cases the duration was 21 days but under 28; 8 persons were ill 28 days or more. Of those remaining, 1 was an out-patient and 3 were still in the hospital wards at the time of investigation.

The situation of the pustule is given in all but one fatal case, which, according to the symptoms, was probably internal. In a majority of cases (20 out of 35) the lesion was on the neck, 9 lesions were on the face, and 5 were on the arm or hand. In 18 of the total number of cases and in 5 of the 6 which ended fatally, examination disclosed anthrax bacilli.¹

CASES REPORTED BY TANNERS AND LEATHER MANUFACTURERS.

In the course of preparing this report the Bureau of Labor Statistics sent about 1,400 circular letters in regard to anthrax to tanners and leather manufacturers. To these, 592 replies were received. Nineteen establishments reported 70 cases of anthrax within the last two or three years, 6 of these cases being fatal.²

While these cases probably duplicate to some extent the cases elsewhere discussed in the report, it is convenient to present them together.

¹ For additional records of Massachusetts cases, see pp. 26, 27, 28, and 89-91.

² At the same time, 1,600 similar inquiries were sent to wool dealers and wool manufacturers, but elicited a report of only one case, that of a Boston laborer trucking wool, who recovered under hospital treatment.

TABLE 5.—ANTHRAX CASES REPORTED BY NINETEEN TANNING AND LEATHER MANUFACTURING ESTABLISHMENTS.

Location.	Firm.	Occupation of victim.	Treatment.	Result.	Precautions now taken.
Maine:					
Island Falls...	No. 1.	Sweater in tannery.	At home—local physician.	Full recovery.	None.
Massachusetts:					
North Woburn.	No. 2.	Tanner.....	At Massachusetts General Hospital.	.....do.....	Have discontinued use of China hides.
		Flesher.....	At home.....	.....do.....	
		Beam-house hand.	At Massachusetts General Hospital.	.....do.....	
Norwood.....	No. 3.	No information.	Local physician.....	.....do.....	No information.
Woburn.....	No. 4.	Beamster....	At Massachusetts General Hospital.	Recovery expected.	Daily examination of all employees.
	No. 5.	2 cases; occupations not given.	.....do.....	Full recovery.	Use solution recommended by State inspectors; stopped tanning dry China hides.
	No. 6.	1 case.....	At home.....	.....do.....	
		5 cases; occupations not given.	Some by local physicians, and others at hospitals.	.....do.....	Carbolacitin used as wash by men, and in soak pits.
Michigan:					
Cheboygan....	No. 7.	3-year-old daughter of beam-house employee.	Antianthrax serum; tincture iodine injected hypodermically around area of infection.	.....do.....	China hides put into corrosive sublimate solution; employees wear wet sponges over mouth and nostrils when unloading these hides.
		Beamster...	Antianthrax serum and early excision of primary lesion.	Full recovery (32 days).	
Munising.....	No. 8.	Beamster...	Sores washed with carbolic acid and iodine; face and neck washed with iodine, vitriol, and camphor oil; gauze pack saturated with boric acid and epsom salts (hot water) applied to face for 5 days; ice-cold baths when fever over 103°.	Full recovery.	Carbolic-acid wash kept on hand for use on cuts, etc.
New Hampshire:					
Whitefield.....	No. 9.	.....do.....	Hospital treatment....	.....do.....	Disinfect hides in solution of bichloride of mercury and common salt.
		.....do.....	.....do.....	.....do.....	
		.....do.....	.....do.....	.....do.....	
New Jersey:					
Camden.....	No. 10.	.....do.....	At home, by company physician.	.....do.....	Antianthrax serum; solution of bichloride of mercury on hand for use by employees.
	No. 11.	Raw - stock department; dry horsehides	Diagnosed as anthrax too late to be treated for same.	Fatal.....	Breaks in skin of employees in raw-stock department cauterized by factory doctor.
		.....do.....	Antianthrax serum; injecting 20 c. c. every 4 to 6 hours; high frequency electricity and fulguration used over primary lesion; lachesis used internally.	Full recovery (3 weeks 4 days).	
		.....do.....	.....do.....	Full recovery (5 weeks 2 days).	
	No. 12.	3 or 4 cases in raw - skin department or in beam house.	Antianthrax serum....	No information.	Doctor in attendance every morning for treatment of minor accidents.
Newark.....	No. 13.	Beamster engaged in trimming hides.	At Newark City Hospital.	Full recovery.	Rubber gloves.

TABLE 5.—ANTHRAX CASES REPORTED BY NINETEEN TANNING AND LEATHER, MANUFACTURING ESTABLISHMENTS—Concluded.

Location.	Firm.	Occupation of victim.	Treatment.	Result.	Precautions now taken
New York: Endicott.....	No. 14.	Unloading hides. Repairman..	At Johnson City Hospital. At Mead's Hospital, Endicott, N. Y.	Fatal..... Full recovery. do.....	Hides whitewashed at shipping point; bales containing hides whitewashed; hides soaked in solution of mercury at tannery.
		Handling hides. Beamster....	do..... do.....	do..... do.....	
Gloversville...	No. 15.	Unloading hides. Beamster....	do..... At home.....	do..... do.....	Gloves to employees in beam house.
	No. 16.	Raw - skin trimmer. Bagging hair from raw material.	do..... do.....	do..... Fatal.....	Raw material naphthalened; solution of weak lime liquor for washing hands.
Pennsylvania: Corry.....	No. 17.	2 cases; occupation not given.	At hospitals.....	Full recovery.	Antiseptic solution for washing hands.
Elkland.....	No. 18.	Handling hides in beam house. do.....	At home..... do.....	do..... do.....	Antianthrax serum on hand.
Various tanneries..	No. 19.	27 cases; occupation not given. 3 cases; occupation not given.	Not given..... do.....	do..... Fatal.....	Immediate care of all wounds; inquiry as to cause of illness if absent.

Of the 70 cases here reported, in 41, or more than half, no information as to occupation is given. Of the remaining 29 victims, the majority (16) were beamsters or beam-house workers, while only 6 are reported to have been working on dry hides. This is apparently a reversal of the ordinary tannery situation, but may be partially accounted for by the unusually large proportion of cases in which the occupation is not given. Other workers affected were a sweater, a flesher, a raw-skin trimmer, one engaged in bagging hair from raw material, and a repair man. Particularly striking is the case of the 3-year old daughter of a beam-house employee, to whom the bacillus was probably carried on her father's clothing.

Information with regard to sanitary precautions, given by the 19 tanneries and leather plants which reported cases, is unusually full. Prophylactic measures ranged from the mere furnishing of a disinfecting wash for the men to daily examination of all employees and even discontinuance of the use of the more dangerous materials. In addition to these 19 plants, 54 which reported no cases indicated that they took precautions as follows:

Instruction to employees of danger.....	10
Immediate treatment of wounds.....	21
Furnishing of gloves.....	23

Furnishing of respirators-----	2
Employ physician -----	1
Employ nurse -----	2
Disinfect hides before handling-----	16

During the summer of 1916 the National Tanners' Association took up the question of more thoroughly disinfecting their plants to guard against contagion from imported hides. Upon applying to the Bureau of Animal Industry for suggestions as to how to proceed with the work, the tannery owners were advised that "next to fire, bichloride of mercury appears to be the most efficient agent in the sterilization of the anthrax spore." The bureau therefore recommended that all parts of the premises be thoroughly sprayed with a 1 to 1,000 bichloride of mercury solution, then scraped and swept (the débris being carefully burned), next scrubbed with the same solution, and finally given another spraying with it, which should be allowed to dry in. Special warning was issued against continuous wetting of the hands or clothes with the solution, in order to avoid mercurial poisoning.²

**FATAL CASES REPORTED IN REGISTRATION AREA OF THE UNITED STATES,
1910 TO 1915.**

During the six years from January 1, 1910, to December 31, 1915, no fewer than 132 deaths from anthrax were officially reported in the United States registration area, which covers less than two-thirds of the total population of the country.³ Were comparable information available for the entire country there is no doubt that this total would be considerably augmented. In Texas, for instance, during the years 1912 to 1915 there were reported to the State board of health four deaths, none of which appears in the United States list

¹ Of the 742 wool dealers or wool manufacturers who replied to the circular letters previously mentioned, the replies of eight indicated that precautions were taken to prevent anthrax. Two establishments reported cautioning their employees to give immediate treatment to cuts and scratches, besides using exhaust fans to carry off the dust; one mill posted notices warning employees not to neglect wounds; four concerns used exhaust fans; and one manufacturer of wool yarns stated that he disinfected hides before handling.

² For full text of the bureau's communication, see Journal of the American Leather Chemists' Association, September, 1916, pp. 510, 511.

³ The registration area in 1913 included 24 States—California, Colorado, Connecticut, Indiana, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Montana, New Hampshire, New Jersey, New York, North Carolina (cities which had 1,000 or more inhabitants in 1900), Ohio, Pennsylvania, Rhode Island, Utah, Vermont, Virginia, Washington, and Wisconsin; and 41 additional cities—Birmingham, Mobile, and Montgomery, Ala.; Wilmington, Del.; Jacksonville, Key West, and Pensacola, Fla.; Atlanta, Augusta, and Savannah, Ga.; Aurora, Belleville, Chicago, Decatur, Evanston, Jacksonville, Quincy, and Springfield, Ill.; Atchison, Coffeyville, Fort Scott, Hutchinson, Independence, Kansas City, Lawrence, Leavenworth, Parsons, Pittsburg, Topeka, and Wichita, Kans.; New Orleans, La.; Lincoln and Omaha, Nebr.; Portland, Oreg.; Charleston, S. C.; Memphis and Nashville, Tenn.; El Paso, Galveston, and San Antonio, Tex.; and Wheeling, W. Va. The population covered at that date was 63,298,718, or 65.1 per cent of the total.

of 132, presumably because they occurred in outlying districts not included in the registration area. Although 12 Kansas cities are so included, a farmer reported to the State board of health as having died of anthrax in 1915 is not among the cases known to the Census Bureau. Similarly a certificate of death from the pulmonary form of the disease filed with the Iowa health department did not get into the Federal statistics because Iowa is entirely outside the registration area. Since the close of 1915, also, at least 23 deaths from anthrax are already known to have occurred.¹ In 15 out of the 23 cases the probable source of the disease can be traced through the occupation or other facts given. Six of the persons worked with skins, hides, or hair, two handled cargoes, and one was a teamster in a seaport town where infected materials are known to have been received. Three were farmers, one a "sheepman," and the death certificate of one, having no occupation, stated that she was infected from a sick cow. A Kansas child was apparently infected by a cat which, it is reported, had the disease. In the absence of specific information as to occupation or surroundings, the cause of the disease can not be traced in the cases of five "laborers," a "foreman in mill," a "housewife," and a boy without stated occupation. This information is, however, scattering and incomplete, and while several of these cases are discussed, as indicated, in the sections of this report dealing with their respective localities, it has been thought best to confine this section of the study to those fatalities officially reported to the United States Bureau of the Census for the six years specified.

Distribution by Industry, Place of Death, Etc.

Of the 132 persons reported as dying of anthrax during this six-year period, 27 were designated on the official death certificates merely as "laborers," a very unsatisfactory classification; 6 others were designated as "laborer, clay," "laborer, paper mill," "laborer in tannery," "laborer, morocco works," "laborer, freight yard," and "laborer, longshore"; 12 as housewives or housekeepers; 9 as farmers; 7 as morocco workers; 3 as stevedores or longshoremen; 2 as liverymen; 2 as barbers; 2 as carpenters; 2 as tailors; 2 as young single women "at home," and 2 as "at school." The following designations occur once each: Handling dry hides, paper-mill hand, tannery worker, leather worker, stationary engineer in morocco works, mixing hair, hair-cloth maker, bristle comber, mill hand in carpet factory, freight agent, freight handler, weigher, ranch foreman, farm hand, veterinary surgeon, hairdresser, merchant, baker, cake baker, candy packer, cigar maker, retired cigar maker, chair maker, painter, molder, printer, mechanic, foreman, electrical supply sales-

¹ See footnote, p 55.

man, domestic, retired pilot, retired farmer, musician, lawyer, druggist, physician, medical student, and undertaker. Eight of the deceased were reported to have had no occupation, and in 10 cases no information on this point was given. Other data on the certificates, however, show that of these last 18 persons, one was a little girl aged 6 and five were infants of 1 year or younger.

In a few cases in which the statement of occupation given on the official death blank did not agree with more precise information subsequently obtained from other sources the real occupation was without significance as regards causation of the disease. Thus one woman who was reported as a cigar maker had left the bench at the time of her marriage, 30 years before she died. One woman who was stated to have no occupation was acting as a housekeeper and nurse, and another was a teacher. A man reported as a lawyer had retired and had no active occupation except caring for his own country home.

On the other hand, in other cases investigation brought out occupational information of great significance. Thus, the man reported as a weigher was employed by the Federal Government in the customs service and had been weighing hides and skins from South America. The one reported as freight handler worked on the wharves and was really a longshoreman. The man reported as a carpenter was employed around a tannery. The man reported as a molder was not engaged at his trade, but for six months previous to death had been a limer and general helper in a leather factory. The man reported as an undertaker had given up his business to become an employee in a tannery establishment, where he checked and received imported horsehides. One young woman who was reported as staying at home helped on her father's dairy farm; two more, designated as housewives, are believed to have contracted the disease from a sheep and from a cow, respectively, which had died of anthrax a few days before; a boy whose occupation was not stated did chores about home; so that all four of these persons may appropriately be classed as farmers. Moreover, of the 30 reported as "laborers," it was found that 6 were tannery employees, 4 were farm or ranch hands, 4 were longshoremen, 1 was a freight handler, 1 a woolsorter, 1 a curled-hair worker, 1 a driver who had been unloading hides from a vessel, 1 a worker in a morocco factory, and 1 a paper-mill employee.

In brief, then, although in about 50 cases the connection between occupation and disease is obscure or nonexistent, 77, or a majority of the persons under consideration, were in occupations where the menace of anthrax is well recognized. Twenty-three were hide and skin workers or were otherwise employed about tanneries, 21 were farmers, ranchmen, or women living on farms, 13 were transporta-

tion workers, 6 worked with wool, hair, or bristles, 2 were rag handlers in paper mills, 2 were liverymen, 1 was a veterinarian, and 9 were laborers, probably in one or another of the foregoing branches of industry.

TANNING.—The largest single occupational group among the 132 recorded persons who succumbed to anthrax in the United States registration area during the six years 1910 to 1915 is composed of tannery employees, of whom there were 23.

While the available information is too fragmentary to permit a positive statement, there is strong reason for believing that most of these 23 workmen were engaged not in the late but in the earliest tannery processes. Thus No. 105, one of the cases given in detail on pages 60 to 78, was unloading at the factory dry South American and Chinese hides. Another (No. 80) was a checker and receiver, and dealt with Russian horse hides. A third (No. 35) had been employed for two years as an assorter of hides. Only with the next man (No. 58), who was a limer and general helper, do we come to an actual tanning process, and even he, at the time of his infection, had been helping store away raw sheepskins. A fifth (No. 87) was a skin washer, while a sixth (No. 50) was a "lumper" in the coloring room of a morocco and calfskin tannery. This last operation, which occurs well along in the tanning process, is the latest one mentioned in any of these cases. Special note should be made of the circumstances that one tannery employee (No. 1) who died was a carpenter and that another (No. 54) was a stationary engineer.¹ The remaining 15 tannery employees (Nos. 2, 3, 5, 10, 20, 41, 49, 69, 74, 93, 94, 97, 103, 126 and 128) are described merely as "laborer in tannery," "morocco worker," or by some similar indefinite term; but, judging from the experience in the groups of local cases previously examined,² it is reasonable to believe that many of these were porters, warehousemen, and the like, who handled the hides in the earliest stages, before actual tanning had begun. Fourteen of the total number here grouped as working at "tanning" are described as employed in tanneries or leather factories (i. e., establishments curing cow, horse, and similar large hides), while nine are described as employed in morocco works, where goat, sheep, and other light skins are tanned.

FARMING AND RANCHING.—Twenty-one of the 132 fatal cases of anthrax under discussion occurred among farmers, ranchmen, or others engaged in similar pursuits. In half of the cases (Nos. 8, 18, 22, 48, 70, 71, 75, 104, 124, and 132) the source of infection remains unknown. One young woman (No. 120) in this group, however, assisted her father on his dairy farm. A boy of 16 (No. 65) helped

¹ For the case of a steam fitter who contracted the disease in a tannery, see p. 36.

² See pp. 32 and 43.

care for his father's cow and horse. A California farm laborer (No. 99) at the time of his attack handled cattle and cattle hides of local origin. A California woman (No. 33) who lived on a farm 16 miles from town is believed to have been infected indirectly from a dead sheep. In the case of another California housewife (No. 84), evidently the wife of a farmer, and in that of a Vermont farm hand (No. 24), the contagion was traced directly to sick cows, one of which died. Three men, in Louisiana, Kansas, and Pennsylvania, respectively (Nos. 26, 15, and 12), were infected by skinning cattle which had died of the disease. A Wisconsin farmer (No. 83) opened a cow to ascertain the cause of its death, and even dissected the characteristic black spots he found in its abdomen. Particularly striking is the story of a New York farmer (No. 78) who, according to the physician, "was in the habit of buying up old and poorly nourished cattle, butchering them, and selling them where he could." While awaiting trial on charges of selling tuberculous meat this man apparently slaughtered for sale an animal suffering from anthrax, and died as a result. The possibility of acquiring the disease by eating the meat of anthrax-infected animals seems to be well recognized.¹

LONGSHORE WORK.—At least 9 of the 13 transportation workers reported as dying from anthrax were longshoremen at the ports of Boston (Nos. 43, 76, 108, 110, and 127), Philadelphia (Nos. 56, 82, and 89), and New York (No. 131). Probably the Boston "freight handler" (No. 4) and the New York "laborer and driver" (No. 116), elsewhere discussed, also belong in this group. Six of the nine men unloaded hides, specified in one instance as coming from South America and from "America"; one unloaded hides and wool; one hair from China; and the nature and source of the materials handled by the other are not stated. The death-bearing hides in two cases are known to have been dry. These hides arrive sometimes in large burlap-wrapped bales, sometimes loose. In either case the labor of fastening tackle upon them, hauling them from the hold, and lugging them onto the pier offers manifold opportunities for abrasions and scratches of the skin, which readily become infected by the spore-laden hides or the dust therefrom. (See cut facing this page.) Five of the lesions in this group appeared on the face, three on the neck, and the position of one is not given. In one of these cases application for indemnity was made under the Massachusetts work-

¹ That the business methods of this man are not unprecedented is shown by the statement of Ravenal that he had "known an animal in the last stages of anthrax to be slaughtered and dressed for market by a thrifty farmer who saw his cow about to die and wished to avoid loss. Examination of the blood of this animal proved it to be swarming with anthrax." (Article on Anthrax in Modern Medicine, 1907, Vol. III, pp. 42-51.)

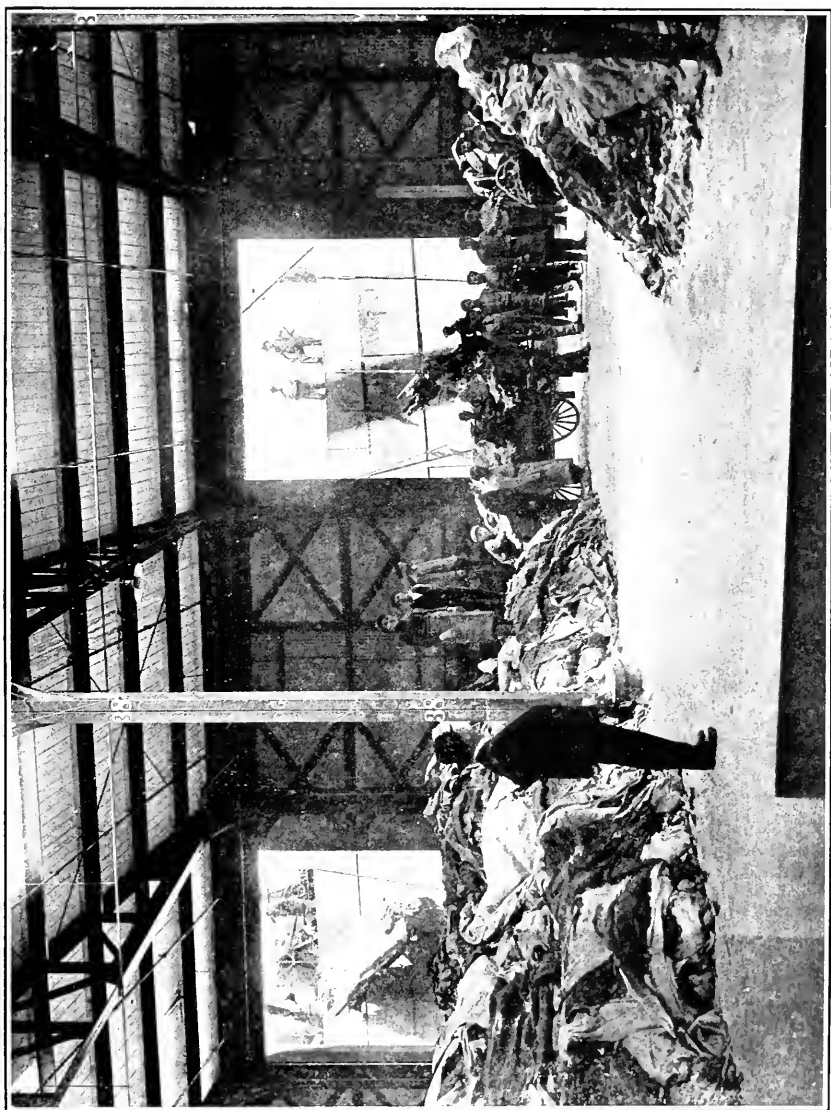


PLATE 6.—UNLOADING A CARGO OF HIDES FROM SOUTH AMERICA.

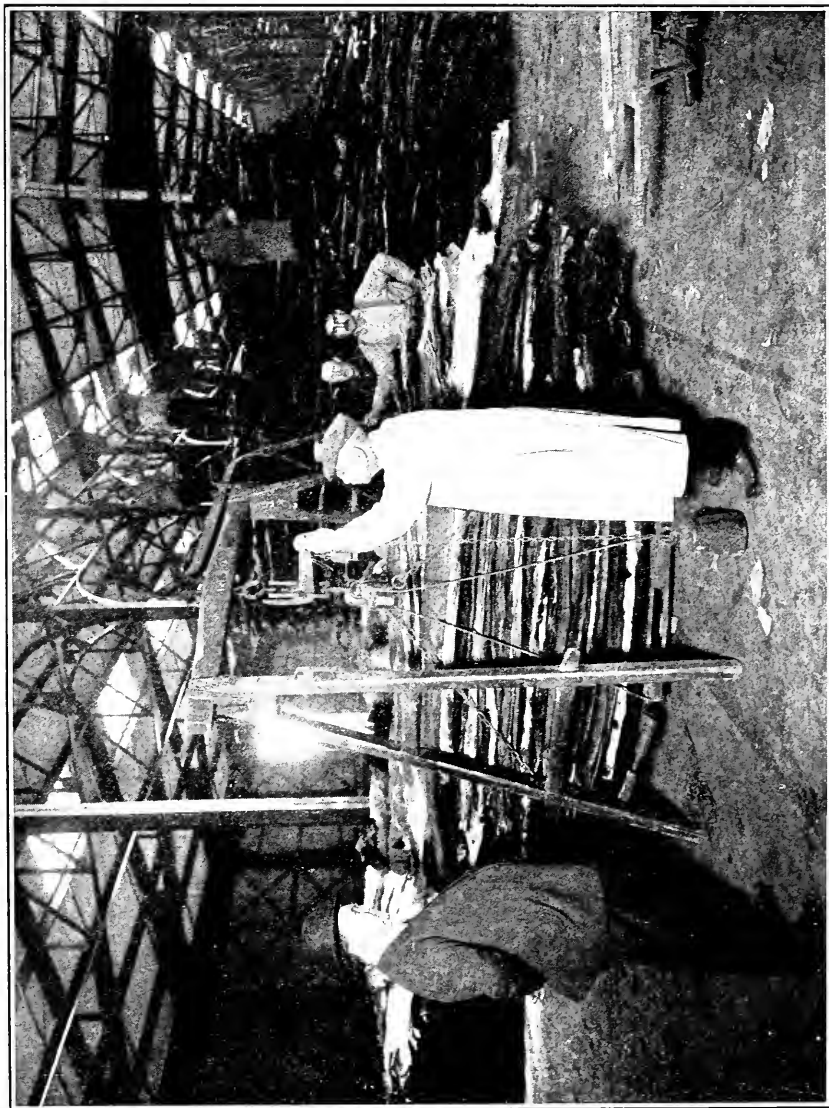


PLATE 7.—WEIGHING DRIED CATTLE HIDES IMPORTED FROM SOUTH AMERICA.

men's compensation law, but was denied on the ground that the infection occurred while the workman was in the employ of a steamship line other than the one named in the application.¹

CUSTOMS WEIGHING.—A case (No. 111) which brought into striking relief the inadequacies of the Federal Employees' Compensation Act of May 30, 1908, was that of a Government weigher in the customs service. This man's duties included tearing open the bales of hides, examining their contents, and weighing them. (See cut facing this page.) Just before falling ill he had worked on hides and skins from South America. His widow, though left with three small children, was unable to secure indemnity from the United States Government because customs weighers were not covered by the act.

TRUCK DRIVING.—Another transportation worker (No. 116) whose attack of anthrax proved fatal is reported as laborer and driver; he had, however, for the week preceding illness, been "unloading hides from a vessel," so that, as previously stated, he probably belongs among the longshoremen. In his case the anthrax papule appeared on the chest.

FREIGHT HANDLING.—The two remaining fatal cases occurring in transportation work were those of freight men—one designated as an agent and the other as a handler (Nos. 61 and 4, respectively). The latter, however, was most likely a Boston longshoreman. His infection was on the right arm. The freight agent worked in a small Pennsylvania town, but nevertheless contracted anthrax from handling foreign hides.

HAIR WORKING AND WEAVING.—Four of those who died of anthrax were engaged in different processes of hair working and hair weaving. One (No. 55) had been employed for only eight months as a laborer in a curled-hair factory using large quantities of imported material. Another (No. 17) mixed animal hair in machines, preparatory to spinning; a third (No. 63) was a haircloth maker and was taken fatally ill after working over a bale of Siberian hair; and the fourth of this group (No. 106) was employed in a carpet factory where the coarser grades of hair are woven.

WOOLSORTING.—One man (No. 7) who succumbed to anthrax came in contact with raw American sheep wool, and according to the physician's statement, was probably a woolsorter. In this work the bales of wool are first placed on racks over steam pipes, which heat the wool and soften the natural grease it contains so that the fleeces can easily be opened out. The workbench has a top of wire screen, through which the dirt and impurities drop, and within easy reach

¹ See pp. 89 and 91.

are a number of baskets or crates, one for each grade of wool which is to be separated. (See cut facing p. 53.) Usually the only tool is a pair of woolsorter's scissors, for clipping off tar and other matter which may be found adhering to the fleece. The whole process is very simple, but gives rise to large quantities of dust; the fine particles of which form convenient vehicles for the anthrax spores.

BRISTLE COMBING.—One fatal case (No. 38) was that of a man employed as a bristle comber and hair dyer. The materials he worked with came from Siberia.

PAPER MAKING.—Two of those who died with anthrax symptoms handled rags in paper mills. One (No. 11) unloaded baled rags from cars, and trucked them into the storage sheds and to the cutting rooms, where the rag cutters would open the bales and feed the rags into the cutting machines. The other (No. 14) was engaged as a bleach boy in the rag room. Both workers handled large quantities of imported rags from such countries as England, Ireland, Germany, France, Italy, and Spain.

LIVERYMEN.—Two of the deaths (Nos. 67 and 95) were among liverymen. The former had a pustule on the lower lip, which at his request was opened with a penknife by a relative. The penknife, however, had previously been used by the patient to incise what he considered an "abscess" on one of his horses, so that the physician is not certain whether the case was anthrax from the start or whether inoculation occurred through the knife. The knife had disappeared and could not be examined for anthrax bacilli.

VETERINARY SURGERY.—One of the most interesting cases of fatal anthrax (No. 47), from the clinical point of view, which was disclosed in this study was that of a veterinary surgeon. Some 12 days before becoming alarmed over his condition he had performed an autopsy on some cows, in the course of which he scratched his forefinger. He cauterized the scratch and nothing developed there, but he probably scratched himself at the same time on the other wrist, for a week later there developed in that location the pustule which caused his death.

BARBERS AND HAIRDRESSERS.—Two of the 132 persons dying of anthrax (Nos. 21 and 77) were barbers and one (No. 40) was a hairdresser. All were men. In none of these cases were details obtainable, but a possible source of infection is indicated by the evidence presented on page 23 regarding infection through shaving brushes. Early in March, 1916, also, the New York city bureau of public health education received a communication from Dr. A. K. Chalmers, health officer of Glasgow, Scotland, stating that two shipments of London-made shaving brushes had been received in Glasgow and that each brush had been found to contain anthrax germs. The New

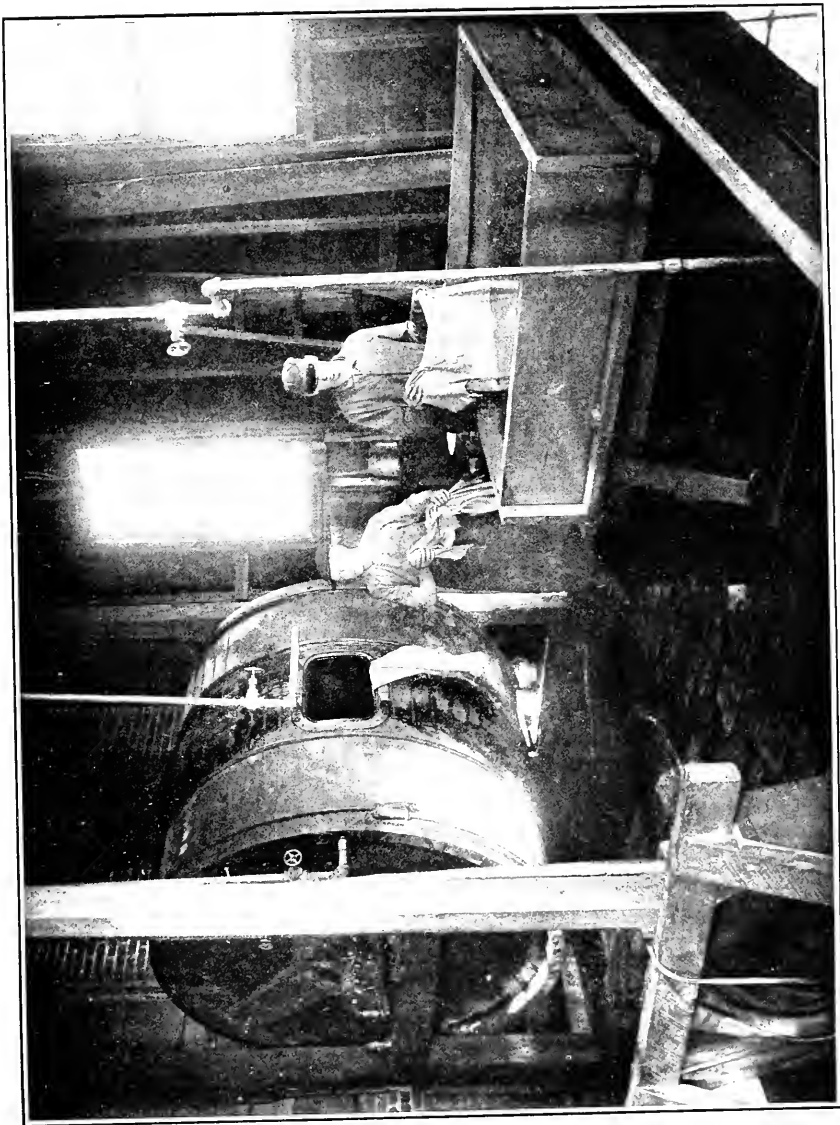


PLATE 8.—A "DRUM" IN WHICH SKINS ARE CHURNED, IN ORDER TO SOFTEN AND REMOVE WASTE MATTER.

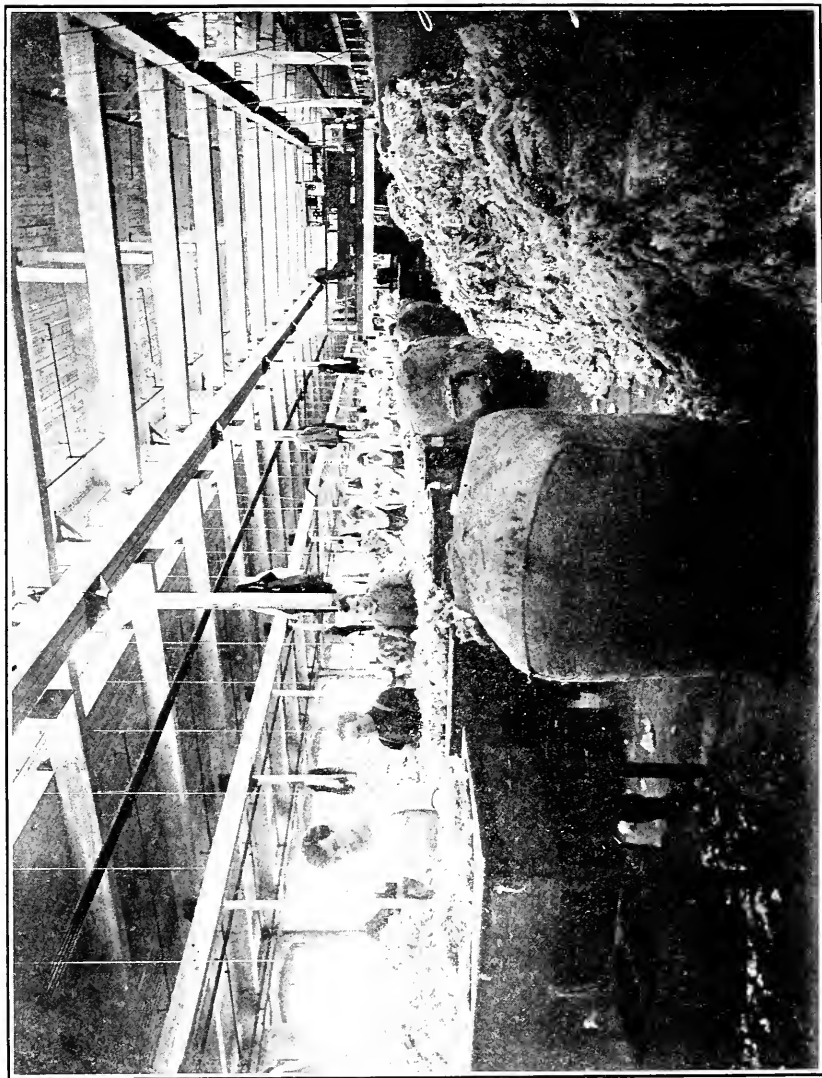


PLATE 9.—WOOL SORTING.

In wool manufacturing centers occupational anthrax is commonly known as "wool sorters' disease."

York health department thereupon announced that all future importations of shaving brushes would be thoroughly examined for the presence of the germs.

"LABORERS."—In nine fatal cases the occupation of the deceased workman is obscured under the vague designation "laborer." Two of these deaths (Nos. 101 and 102) occurred within two and one-half weeks of each other in Pennsylvania tannery towns, a third (No. 29) occurred in a Massachusetts city with large shoe works as well as tanneries; and a fourth (No. 34) took place in Philadelphia, where in both hair works and tanneries the risk of occupational anthrax is great. In these cases what the victims worked at can be surmised with approximate accuracy, but in the remaining five cases (Nos. 25, 31, 42, 91, and 109) there is no clue whatever. From the standpoint both of accurate morbidity statistics and of efficient prevention of occupational disease, such loose reporting should be discouraged.

MUSICIAN.—One man (No. 30) was a traveling musician, and at the time of his death is believed to have been with a circus. As he was fond of horses it is suggested that he may have contracted the disease from one of the circus animals.

HOUSEKEEPING.—Fourteen of the fatalities reported as from anthrax occurred among women who were acting as housewives (Nos. 6, 9, 39, 53, 57, 68, 85, 96, and 119), housekeepers (Nos. 28 and 52), housekeepers and nurses (No. 66), domestics (No. 62), or (No. 92) simply living "at home" with no definite occupation. In no case is the source of infection indicated.

INFANTS.—Five of the reported victims of anthrax were infants 1 year old or less. In three of these cases (Nos. 16, 73, and 88) the mode of infection is unknown. A girl baby of 4 months (No. 64) was struck on the mouth with a fly swatter in the hands of an older child who was tending her, breaking the skin and perhaps introducing the fatal bacillus or spore from a fly which had previously been killed with the implement. The physician's history in the remaining case (No. 98) is most convincing. This little boy, aged 1, lived on a farm. He was scratched on the leg by the teeth of a pet dog with which he was playing. The dog had been feeding on the unburied carcass of a calf that had died of anthrax. A pure culture of anthrax was taken from the child's leg.

No OCCUPATION.—Of the eight persons who, according to the official death blanks, had no occupation, six are elsewhere considered. The seventh (No. 32) was a man of 38, and the last (No. 79) a girl of 14. In none of these cases could additional information of importance be secured.

OCCUPATION NOT STATED.—In seven cases the occupation was not stated on the official death certificates and could not be determined

from other sources. Three of these (Nos. 81, 86, and 117) were men, aged 52, 54, and 52 years, respectively. One (No. 107) was a girl 6 years old, the discharges from whose nose contained a bacillus "having all the characteristics of the bacillus anthracis." The other three were women. One (No. 113) was on a visit to New York when she pricked a pimple on her lip with a needle. The records for the remaining two (Nos. 13 and 37) are brief and afford no clue to the cause of the disease.

MISCELLANEOUS CASES, OCCUPATION NOT SIGNIFICANT.—There remain 23 recorded victims of fatal anthrax attacks whose occupations, as given by the official death certificates, checked up from other sources, bear no visible relation to the disease and are too scattered to be considered in groups. The cause of infection in a few of these cases has been roughly surmised. A tailor (No. 90) and a young woman school-teacher (No. 44) are believed by their physicians to have been infected by insect bites. Two girls, one (No. 115) a post-office clerk, and the other (No. 121) a candy packer, are supposed by some physicians to have contracted the disease from fur neck pieces, but this theory is opposed by medical men of high standing. In the 19 cases still remaining no explanation for the onset of the disease has been offered.

PLACE AND DATE OF DEATH.—Just half of the total number of deaths, or 66 in all, occurred in the three States of Pennsylvania, New York, and Massachusetts. The distribution by States in detail was—Pennsylvania, 31; New York, 23; Massachusetts, 12; California and Ohio, 9 each; Connecticut, 8; Delaware, 7; Louisiana, Minnesota, and New Jersey, 4 each; Indiana and Kentucky, 3 each; Colorado, Missouri, Wisconsin, Virginia, and Maine, 2 each; Washington, Montana, Utah, Nebraska, Maryland, and Vermont, 1 each.

Grouped by years, the deaths took place as follows: Nineteen hundred and ten, 22; 1911, 14; 1912, 17; 1913, 25; 1914, 19; 1915, 35; total, 132.

Considered by months, there seemed to be a period of high frequency during March, April, and May, followed by a lull in the summer and early autumn, and another high-frequency period, even higher than the first, toward the close of the year. In half of the six years, the largest number of deaths in any single month occurred in March or May; in two years it occurred in November and December; and in the remaining year the three months which had the same high number of fatalities were March, April, and December. Whether this apparently regular fluctuation is accidental only or indicates a real variation in the risk of infection can not yet be decided.

NATIVITY, AGE, SEX, AND CONJUGAL CONDITION.—Seventy-nine, or not quite three-fifths, of the persons who died of anthrax in these

six years were born in America, and 51 of them died in the States where they were born. There were also 8 Russians, 7 Poles, 6 Irishmen, 5 Germans, 5 Austrians, 5 Italians, 5 Canadians, 3 Englishmen, 3 Scotchmen, 1 Frenchman, 1 Greek, 1 Bohemian, 1 Hungarian, 1 Swede, and 1 native of the Azores Islands. Their ages ranged from 3 months to 81 years, but more died between the ages of 31 and 40 and 51 and 60 than in any other age decade. One hundred three were males, and 29 were females. Seventy-nine were married, 46 single, 6 widowed, and 1 was divorced.^a

STATISTICAL SUMMARY.

The following table presents in chronological order the 132 deaths recorded as from anthrax in the United States during the six years 1910 to 1915, inclusive, showing the place of death, birthplace, conjugal condition, date of death, age, occupation, and recorded cause of death:

TABLE 6.—DEATHS FROM ANTHRAX REPORTED IN THE UNITED STATES, 1910 TO 1915.
[Data drawn from official certificates of death.]

Case No.	Place of death.	Birthplace.	Conjugal condition.	Date of death.	Age.	Occupation.	Cause of death.
				1910			
1	Elmira, N. Y.....	Pa.....	M.	Jan. 2	39	Carpenter 1.....	Anthrax (external); tetanus.
2	Wilmington, Del.....	Germany	M.	Jan. 10	50	Morocco worker...	Anthrax.
3	San Francisco, Cal.....	Greece...	S.	Jan. 11	24	Laborer 2.....	Exhaustion; anthrax.
4	Boston, Mass.....	Ireland...	S.	Jan. 29	34	do 3.....	Anthrax.
5	Philadelphia, Pa.....	England...	M.	Feb. 15	32	do 3.....	Do.
6	Jackson, Ohio.....	Ohio.....	M.	Mar. 8	68	Housewife.....	Septicæmia; anthrax and Bright's.
7	Williamsport, Pa.....	Italy.....	M.	Mar. 28	51	Laborer 4.....	Anthrax.
8	Pierceton, Ind.....	Ind.....	M.	Apr. 1	52	Law and farming..	Anthrax; heart failure.
9	Reading, Pa.....	Pa.....	S.	Apr. 22	49	Cigar maker 5.....	Anthrax.
10	Wilmington, Del.....	Del.....	S.	June 4	17	Morocco worker...	Do.

Special inquiry disclosed that the actual occupation just prior to death was as—

¹ Carpenter at tannery.

² Laborer in tannery.

³ Freight handler.

⁴ Worker with raw sheep wool; probably a woolsorter.

⁵ Housewife.

^a Between the beginning of 1916 and the final proof reading of this report (Dec. 24, 1916), 18 additional cases of death from anthrax had been discovered by clerks in the Census Office in the course of their routine compilation of death certificates for that year. The victims were, in chronological order: "Sheepman," Columbia County, Wash.; Occupation not given, Hodgenville, Ky., anthrax infection from sick cow; Wool washer, Johnstown, N. Y.; Tanner, Chicago; Boy, occupation not given, New York city; "Laborer," Boston; Foreman in mill, Philadelphia; "Laborer," Philadelphia; Farmer, Goldsboro, N. C.; Teamster, Boston; "Laborer," Philadelphia; Longshoreman, Boston; "Laborer," St. James, Mo.; Farmer, Glendale Springs, N. C.; Currier, Boston; "Laborer," Philadelphia; Farmer, Beaumont, Tex.; Housewife, San Antonio, Tex. In an account of the outbreak in Massachusetts, 1916, in the United States Public Health Reports for Dec. 15, 1916, the two additional fatalities were recorded of a tannery worker (beam house), Winchester, and a dock laborer, Chelsea. Two other cases of death traced through the United States Public Health Reports and through newspaper accounts, respectively, were that of a curled-hair worker in Detroit, Mich., on Aug. 12, 1916, after an illness of 24 hours, and of a tannery worker in Arroyo, Pa., on Nov. 19, 1916. There was likewise on record the fatal case of a Kansas child who was apparently infected by a cat. Several of these cases have already been discussed in the sections dealing with the experience of particular States or hospitals.

TABLE 6.—DEATHS FROM ANTHRAX REPORTED IN THE UNITED STATES, 1910 TO 1915—
Continued.

Case No.	Place of death.	Birth-place.	Conjugal condition.	Date of death.	Age.	Occupation.	Cause of death.
				1910			
11	Greensburg, Pa.....	Austria.	M.	June 29	34	Laborer, paper mill.	Anthrax; septic intoxication.
12	Howe, Pa.....	Canada.	M.	July 19	52	.....do.....	Anthrax; skinning cow dead with the disease.
13	Philadelphia, Pa.....	England	W.	Aug. 8	60	Not reported.....	Anthrax; bronchitis.
14	Holyoke, Mass.....	Mass.....	S.	Aug. 20	15	Paper mill ¹	General sepsis; anthrax.
15	La Junta, Colo.....	Scotland	M.	Oct. 2	46	Ranch foreman....	Anthrax.
16	Fairport, Ohio.....	Ohio....	S.	Oct. 13	4	None.....	Cramps—disease of bowel; anthrax.
17	Baltimore, Md.....	Germany	M.	Dec. 2	62	Mixing hair (animal) in machines, preparing for spinning.	Toxemia; anthrax.
18	Pomona, Cal.....	Ill.....	M.	Dec. 8	72	Farmer (retired)...	Anthrax; senility.
19	Newcastle, Pa.....	Pa.....	W.	Dec. 19	78	Baker.....	Anthrax; exhaustion following disease.
20	Elmira, N. Y.....	N. Y....	M.	Dec. 22	46	Mechanic ²	Anthrax, external, and general toxemia.
21	Fresno, Cal.....	Germany	M.	Dec. 28	52	Barber.....	Anthrax, followed by septic abscesses and pyemia.
22	Kittery, Me.....	Me.....	M.	Dec. 29	24	Farmer.....	Septicemia with malignant pustule.
				1911			
23	Canastota, N. Y.....	N. Y....	M.	Jan. 27	75	Cigar maker (retired).	Anemia; malignant pustule, right cheek.
24	Waterford, Vt.....	Vt.....	M.	Feb. 28	29	Laborer ³	Anthrax.
25	Harrison, Ind.....	Ind.....	S.	Apr. 28	62	.....do.....	Anthrax; septicemia.
26	New Orleans, La.....	La.....	M.	Apr. 28	34	Farmer.....	Anthrax.
27	Windham Co., Conn....	Conn....	S.	May 7	72	Tailor ⁴	Do.
28	New Britain, Conn....	Ireland..	M.	May 16	52	Housekeeper.....	Anthrax (malignant pustule); septicemia.
29	Lynn, Mass.....	..do.....	S.	May 30	38	Laborer.....	Anthrax; pulmonary tuberculosis.
30	Cleveland, Ohio.....	Bohemia	M.	June 21	40	Musician ⁵	Malignant pustule; edema of glottis.
31	Monterey, Cal.....	Cal.....	D.	July 10	38	Laborer.....	Anthrax; acute uremia.
32	Dubois, Pa.....	Hungary	M.	July 28	38	None.....	Anthrax; anthrax edema.
33	Bakersfield, Cal.....	France..	M.	Oct. 16	42	Housewife.....	Anthrax.
34	Philadelphia, Pa.....	Austria.	M.	Nov. 7	38	Laborer.....	Anthrax; due to bacillus anthracis.
35	Wilmington, Del.....	Pa.....	M.	Nov. 20	48	Assorter of hides, morocco works...	Anthrax.
36	New Orleans, La.....	La.....	S.	Dec. 27	25	Salesman, electric supplies.	Anthrax (carbuncle); malignant pustule.
				1912			
37	Logan County, Ky....	Ky.....	M.	Feb. 3	51	Not reported.....	Malignant pustule; heart paralysis.
38	Philadelphia, Pa.....	Pa.....	M.	Feb. 6	52	Bristle comber ⁶ ...	Anthrax.
39	Mesopotamia, Ohio....	Ohio....	M.	Feb. 13	30	Housewife.....	Malignant pustule on right side of face; abscess of right kidney.
40	Philadelphia, Pa.....	Md.....	M.	Mar. 2	47	Hairdresser.....	Anthrax.
41	Wilmington, Del.....	Russian Poland	S.	Mar. 6	19	Morocco worker ⁷ ..	Do.

Special inquiry disclosed that the actual occupation just prior to death was as—

¹ Bleach boy in rag room of paper mill.² Handler of hides in leather company.³ Farm laborer.⁴ Tailor and presser.⁵ Musician traveling with circus.⁶ Bristle comber and hair dyer.⁷ Morocco worker; probably in the beam house.

TABLE 6.—DEATHS FROM ANTHRAX REPORTED IN THE UNITED STATES, 1910 TO 1915—
Continued.

Case No.	Place of death.	Birth-place.	Con-jugal condition.	Date of death.	Age.	Occupation.	Cause of death.
42	Toledo, Ohio.....	Ohio....	M.	1912 Mar. 7	57	Laborer.....	Exhaustion from chronic cystitis, blood poisoning; anthrax—malignant pustules on leg and hand.
43	Boston, Mass.....	Mass....	S.	Mar. 9	26	Laborer—long-shore. ¹	Septicemia; anthrax.
44	New York, N. Y.....	N. Y.....	S.	June 2	18	Not reported ²	Malignant pustule.
45	Cincinnati, Ohio.....	Ohio....	W.	July 23	81	Retired pilot.....	Anthrax or carbuncle; septicemia and asthenia.
46	Allegheny County, Pa.	Ireland..	M.	Aug. 6	55	Foreman.....	Anthrax.
47	Orange, N. J.....	N. J.....	M.	Sept. 13	52	Veterinary surgeon	Inoculation by anthrax bacilli, causing general systemic poisoning.
48	Richland, Mo.....	Ind.....	M.	Oct. 14	59	Farmer.....	Anthrax.
49	Philadelphia, Pa.....	Russia..	M.	Nov. 14	34	Laborer ³	Do.
50	Peabody, Mass.....	do.....	M.	Nov. 18	20	Morocco ⁴	Do.
51	St. Paul, Minn.....	Minn....	S.	Nov. 20	7	At school.....	Malignant pustule; blood poisoning.
52	Graves County, Ky....	Ky.....	M.	Dec. 4	17	Housekeeper.....	Anthrax.
53	Ballard County, Ky....	Tenn....	M.	Dec. 23	28	Housewife.....	Do.
54	Wilmington, Del.....	Md.....	M.	1913 Jan. 19	39	Morocco, station-ary engineer.	Malignant pustule.
55	Philadelphia, Pa.....	Poland..	M.	Jan. 23	30	Laborer ⁵	Anthrax carbuncle of neck.
56	do.....	Del.....	M.	Feb. 13	55	do. ⁶	Anthrax.
57	Snohomish County, Wash.	Wis.....	M.	Feb. 15	58	Housewife.....	Anthrax of right hand.
58	Gloversville, N. Y.....	Ireland..	M.	Mar. 1	37	Molder ⁷	Anthrax; edema of glottis.
59	Brooklyn, N. Y.....	Italy....	M.	Apr. 6	46	Druggist.....	Anthrax of the neck; fatty degeneration of heart.
60	Gardner, Mass.....	Mass....	M.	Apr. 12	33	Chair maker.....	Anthrax infection of face.
61	Cascade, Pa.....	Pa.....	M.	May 2	34	Freight agent ⁸	Anthrax.
62	Racine, Wis.....	Russia..	M.	May 5	33	Domestic.....	Malignant pustule on face, also internal in mouth; edema of glottis.
63	Philadelphia, Pa.....	Poland..	M.	May 9	25	Hairecloth maker.	Anthrax.
64	Wilkes-Barre, Pa.....	Pa.....	S.	May 28	4 mos.		Malignant pustule.
65	Hennepin County, Minn	Minn....	S.	July 17	16	Laborer ⁹	Anthrax.
66	North Attleboro, Mass.	Canada..	W.	July 20	76	None ¹⁰	Malignant pustule.
67	Windsor Locks, Conn.	Conn....	M.	Aug. 5	49	Liveryman.....	Malignant pustule; septicemia.
68	Brighton, Pa.....	Pa.....	M.	Aug. 13	34	Housewife.....	Anthrax.
69	Wilmington, Del.....	Ireland..	S.	Aug. 23	54	Morocco worker.....	Do.
70	Lincoln, Mo.....	Mo.....	S.	Sept. 8	28	Farmer.....	Anthrax; metastatic pneumonia.
71	Gates, N. Y.....	N. Y.....	S.	Sept. 29	16	Not reported ¹¹	Splenic fever; malignant facial anthrax.
72	Elyria, Ohio.....	Ohio....	M.	Oct. 7	67	Physician.....	Anthrax; chronic nephritis.
73	Unlty, Pa.....	Pa.....	S.	Oct. 22	1	None.....	Cholera infantum and anthrax.

Special inquiry disclosed that the actual occupation just prior to death was as—

¹ Longshoreman handling hides.

² School-teacher.

³ Laborer in tannery.

⁴ Lumper in coloring room of morocco and calfskin factory.

⁵ Laborer in curled-hair factory.

⁶ Longshoreman loading hides and wool.

⁷ Limer and general helper in leather-dressing establishment.

⁸ Freight agent handling foreign hides.

⁹ General helper on small-fruit farm.

¹⁰ Housekeeper and nurse.

¹¹ Chore-boy around home.

TABLE 6.—DEATHS FROM ANTHRAX REPORTED IN THE UNITED STATES, 1910 TO 1915—
Continued.

Case No.	Place of death.	Birth-place.	Con-jugal condition.	Date of death.	Age.	Occupation.	Cause of death.
74	Lycoming County, Pa.	N. Y....	M.	1913 Oct. 23	52	Handling dry hides. ¹	Anthrax; infection upon the neck.
75	Hanford, Cal.....	Azores Islands.	S.	Nov. 11	33	Laborer ²	Anthrax.
76	Boston, Mass.....	Mass.....	S.	Dec. 13	23	Longshoreman ³ ..	Anthrax; toxemia.
77	Winchester, Va.....	Md.....	M.	Dec. 20	46	Barber.....	Blood poisoning, the result of anthrax.
78	Union, N. Y.....	N. J.....	S.	Dec. 24	56	Farmer ⁴	Anthrax infection.
79	South Windsor, Conn..	Conn....	S.	1914 Jan. 16	14	None.....	Anthrax or malignant pustule; toxemia.
80	Camden, N. J.....	N. J.....	M.	Jan. 29	47	Undertaker ⁵	Anthrax (malignant pustule); infected from handling hides in a local leather factory.
81	Fremont, Ohio.....	Ohio....	M.	Mar. 9	52	Not reported.....	Rheumatism and anthrax; pericarditis.
82	Philadelphia, Pa.....	N. C.....	S.	Mar. 15	30	Stevedore ⁶	Anthrax.
83	Pleasant Prairie, Wis.	Ill.....	M.	Mar. 20	55	Farmer.....	Anthrax; general infection.
84	Calexico, Cal.....	Scotland	M.	Apr. 6	70	Housewife.....	Septicemia, almost certainly due to anthrax in a cow.
85	Philadelphia, Pa.....	Poland..	M.	do.....	38	do.....	Anthrax.
86	Norfolk, Va.....	Va.....	M.	Apr. 11	54	Not reported.....	Anthrax (malignant edema); toxemia.
87	Philadelphia, Pa.....	Germany	M.	May 6	60	Leather worker ⁷ ..	Anthrax.
88	New Orleans, La.....	La.....	S.	May 29	3 mos.	None.....	Anthrax at base of spine; scrofula.
89	Philadelphia, Pa.....	Md.....	S.	June 17	35	Laborer ⁸	Anthrax.
90	Cincinnati, Ohio.....	Ohio....	M.	Aug. 8	41	Tailor and presser.	Anthrax infection of face; nephritis, acute.
91	Lewiston, Me.....	Canada .	M.	Aug. 19	45	Laborer.....	Endocarditis; chronic rheumatism; anthrax.
92	Hollidaysburg, Pa.....	Pa.....	S.	Sept. 10	18	At home.....	Malignant pustule.
93	Wilmington, Del.....	Russia..	M.	Oct. 10	29	Morocco worker...	Anthrax; edema of larynx.
94	Brooklyn, N. Y.....	Germany	W.	Nov. 25	56	Laborer ⁹	Anthrax; infection bacillus anthracis.
95	McKeesport, Pa.....	Va.....	M.	Dec. 8	42	Liveryman.....	Anthrax.
96	Lincoln, Nebr.....	Iowa....	M.	do.....	39	Housewife.....	Septic infection due to anthrax bacillus.
97	Camden, N. J.....	Poland..	M.	Dec. 31	53	Laborer, morocco works.	Anthrax.
98	Fort Morgan, Colo.....	Canada .	S.	1915 Mar. 29	1	None.....	Anthrax; measles.
99	Fresno, Cal.....	Italy....	S.	Apr. 3	25	Laborer ¹⁰	Anthrax; due to bacillus anthracis.
100	Hartford City, Ind.....	Ohio....	M.	Apr. 4	69	Merchant.....	Malignant anthrax.
101	Williamsport, Pa.....	Austria .	M.	Apr. 25	53	Laborer.....	Anthrax causing edema of larynx, facial anthrax.
102	Coudersport, Pa.....	do.....	S.	May 12	31	do.....	Anthrax, internal; typical case of true anthrax.
103	do.....	do.....	M.	May 18	29	do. ⁹	Septic infection; typical case of true anthrax.
104	Nunda, N. Y.....	N. Y.....	S.	May 24	14	Farmer and student. ¹¹	Septicemia; anthrax of back.

Special inquiry disclosed that the actual occupation just prior to death was as—

¹ Handler of dry hides in tannery.² Ranch laborer.³ Longshoreman handling hides.⁴ Farmer who made a practice of butchering cattle.⁵ Checker and receiver of horsehides in leather factory.⁶ Stevedore unloading hair.⁷ Skin washer in leather factory.⁸ Longshoreman unloading hides.⁹ Laborer in tannery.¹⁰ Farm laborer handling cattle and cattle hides.¹¹ Schoolboy who also did chores around home.

TABLE 6.—DEATHS FROM ANTHRAX REPORTED IN THE UNITED STATES, 1910 TO 1915—
Concluded.

Case No.	Place of death.	Birth-place.	Con-jugal condition.	Date of death.	Age.	Occupation.	Cause of death.
105	Endicott, N. Y.....	Russia..	M.	1915 June 1	22	Tannery worker ¹ ..	Bacillus anthrax; septicemia; anthrax.
106	Hartford, Conn.....	Poland..	M.	June 7	35	Mill hand, carpet factory.	Anthrax infection; genuine anthrax; from initial ulceration of neck.
107	Brooklyn, N. Y.....	N. J.....	S.	June 29	6	Not reported.....	General asthenia from anthrax infection of nose.
108	Boston, Mass.....	New Brunswick.	S.	July 4	50	Stevedore ²	Anthrax.
109	New Orleans, La.....	La.....	S.	July 8	23	Laborer.....	Acute nephritis; edema of lungs; bacillus anthracis; septicemia.
110	Boston, Mass.....	Russia..	M.	...do....	38	Laborer, freight yard. ³	Anthrax; neck infection with bacillus anthracis.
111	Manhattan, N. Y.....	N. Y....	M.	July 29	34	Weighter ⁴	Anthrax infection of neck.
112	Salt Lake City, Utah..	N. Y....	S.	Aug. 24	65	Carpenter	Anthrax.
113	Manhattan, N. Y.....	Md.....	S.	Aug. 30	20	Not reported.....	Pustula maligna on under lip; pyemia; anthrax.
114	New London, Conn...	N. Y....	S.	Sept. 3	57	Printer	Malignant pustule; convulsions.
115	Brentwood, N. Y.....	N. Y....	S.	Sept. 29	23	None ⁵	Malignant anthrax edema.
116	Manhattan, N. Y.....	U. S....	S.	Oct. 7	52	Laborer ⁶	Anthrax.
117	Madison, N. Y.....	N. J....	S.	Oct. 12	52	Not reported.....	Poison from anthrax; cardiac paralysis.
118	Manhattan, N. Y.....	U. S....	M.	Oct. 15	71	Lawyer ⁷	Anthrax.
119	Blue Earth Co., Minn..	Minn....	M.	Oct. 22	35	Housewife.....	External and internal anthrax.
120	Bainbridge, N. Y.....	N. Y....	S.	Nov. 12	24	At home ⁸	Septicemia; probably anthrax bacillus.
121	Manhattan, N. Y.....	Russia..	S.	Nov. 18	17	Candy packer.....	Anthrax.
122	Philadelphia, Pa.....	Scotland	M.	Nov. 20	69	Cake baker.....	Septicemia due to malignant pustule on hip; cirrhosis of liver.
123	Johnson City, N. Y...	Pa.....	M.	...do....	49	Laborer in tannery	Anthrax.
124	Lewistown, Mont.....	England	S.	Nov. 21	16	Farm hand.....	Anthrax infection; septicemia.
125	Kings County, Cal....	Ohio....	M.	Nov. 26	56	Painter ⁹	Anthrax on back of neck; exhaustion.
126	New Brunswick, N. J..	Italy....	M.	...do....	25	Laborer, clay ¹⁰ ...	Cellulitis of neck; sepsis; anthrax; valvular heart disease.
127	Chelsea, Mass.....	Poland..	M.	Nov. 27	40	Freight handler...	Anthrax; malignant pustule.
128	Boston, Mass.....	Italy....	M.	...do....	31	Laborer ¹¹	Anthrax.
129	Manhattan, N. Y.....	N. Y....	S.	Nov. 28	25	Medical student...	Malignant anthrax; edema.
130	Willington, Conn.....	N. Y....	S.	Dec. 5	9	At school.....	Malignant pustule; general septicemia.
131	Brooklyn, N. Y.....	Russia..	M.	Dec. 18	45	Laborer ¹²	Anthrax; edema of glottis; acute cardiac dilatation.
132	St. Paul, Minn.....	Sweden .	W.	Dec. 27	60	Farmer.....	Malignant anthrax (carbuncle) on back of neck.

Special inquiry disclosed that the actual occupation just prior to death was as—

¹ Worker in leather factory, unloading dry hides.² Longshoreman working in hold of vessel and unloading dried hides.³ Laborer unloading dry hides at wharves.⁴ Weighter in United States customhouse.⁵ Clerk in post office.⁶ Laborer and driver, and unloading hides from vessel.⁷ Retired lawyer, caring for his own home.⁸ Helper on father's dairy farm, doing housework and milking.⁹ Laborer with no particular kind of work.¹⁰ Laborer working in clay pit.¹¹ Worker in tannery.¹² Laborer handling hides at docks.

Individual Histories of Fatal Cases.

In this section a more detailed account is given of each of the foregoing 132 cases of death from anthrax. The facts were secured by correspondence and interviews with hospital authorities and with attending physicians, supplemented in some cases by visits to the family and friends of the deceased. By such inquiries many additional particulars were obtained which were important as throwing light on the relation between occupation and cause of death.

No. 1, of Elkland, Pa., died at the age of 39 on January 2, 1910, of "anthrax (external); tetanus." He was a carpenter at a tannery, and upon contracting the infection from hides was sent to Elmira, N. Y., to be treated by a physician who had previously practiced near Elkland and had had much experience with anthrax. "I think," says the physician, "he would have recovered from anthrax if tetanus had not developed about two weeks after the appearance of anthrax symptoms; he lived only 24 hours from the time tetanus developed. Of course he probably would not have developed tetanus if he had not suffered from anthrax first." As near as the physician could find out the diseased hides "were imported from South American countries, and from cattle that had died of anthrax." The physician further states that in five years' practice near Elkland he treated "quite a number of cases suffering from anthrax contracted by employees handling hides" at the tanneries of three neighboring towns, and that this was his "first case that succumbed to the disease."

No. 2, of Wilmington, Del., died at the age of 50 on January 10, 1910, of "anthrax." He was a morocco worker by trade.

No. 3, of San Francisco, Cal., died at the age of 24 on January 11, 1910, of "exhaustion; anthrax." He was a laborer in a tannery, where, according to the physician, he became infected by hides. The illness lasted only three days, and death occurred in a hospital.

No. 4, of Boston, Mass., died at the age of 34 on January 29, 1910, of "anthrax." He was a freight handler. His right arm was affected. Upon admission to the hospital an excision of the affected area was made. Serum was not used. A pure growth of anthrax bacilli was obtained from the blood. He had been in the hospital about a day when death occurred.

No. 5, of Philadelphia, Pa., died at the age of 32 on February 15, 1910, of "anthrax." For six weeks preceding his illness he had worked as a laborer in a tannery. According to the hospital physician, the disease began three weeks prior to his admission to the hospital "with a small pustular eruption on the face. Next day the neck became edematous, until on admission the whole neck was purplish in color and doughy to the feel." He died on the day he was admitted to the hospital.

No. 6, of Jackson, Ohio, died at the age of 68 on March 8, 1910, of "septicemia; anthrax and Bright's." She was a housewife.

No. 7, of Williamsport, Pa., died at the age of 51 on March 28, 1910, of "anthrax." The physician states that the man came in contact with raw sheep wool of American origin, and that he probably was a wool sorter. The disease took the form of "malignant pustule—external anthrax," according to the physician, who goes on to say: "He had all the classic symptoms, especially a marked edema of shoulder which spread to face and breast. He lived about five days. Crucial incisions were made about shoulder and breast. No relief was derived from this treatment." Anthrax bacilli were found. Antianthrax serum was not available at the hospital where the patient was treated.

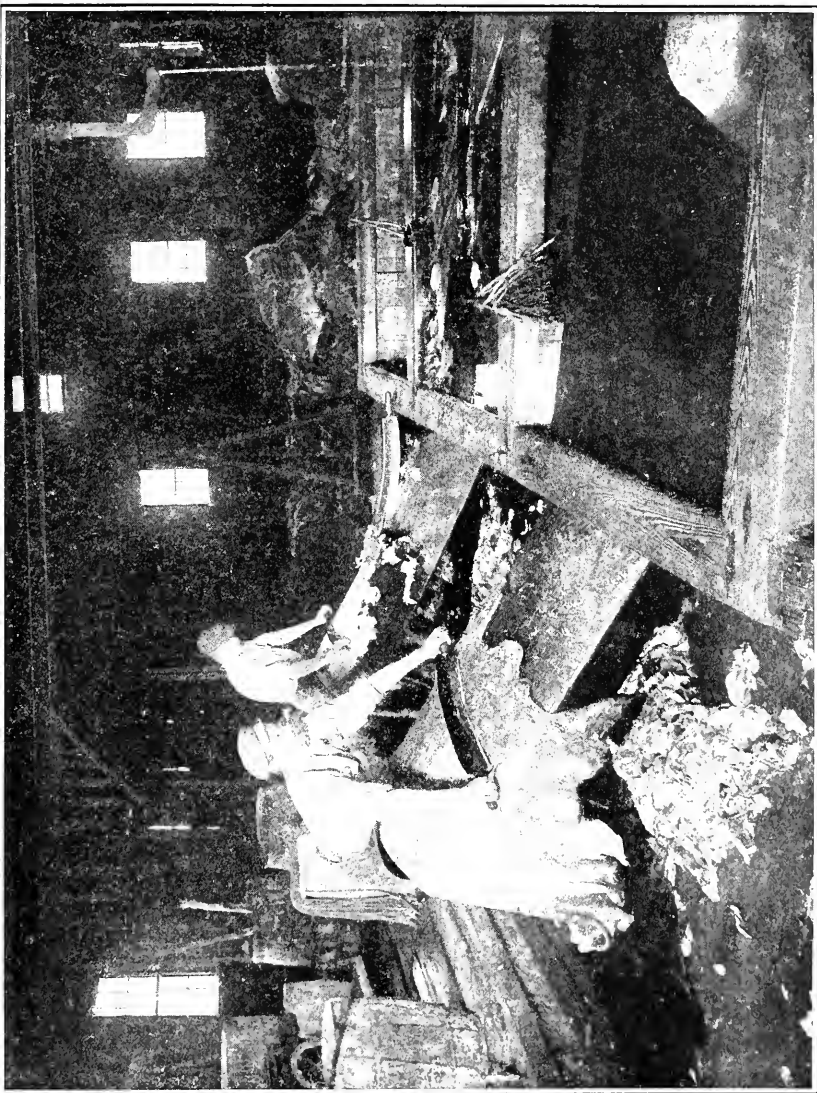


PLATE 10.—A "BEAM HOUSE" IN A TANNERY.

Scraping hides taken from lime vats in which they have been submerged until the hair is loosened.

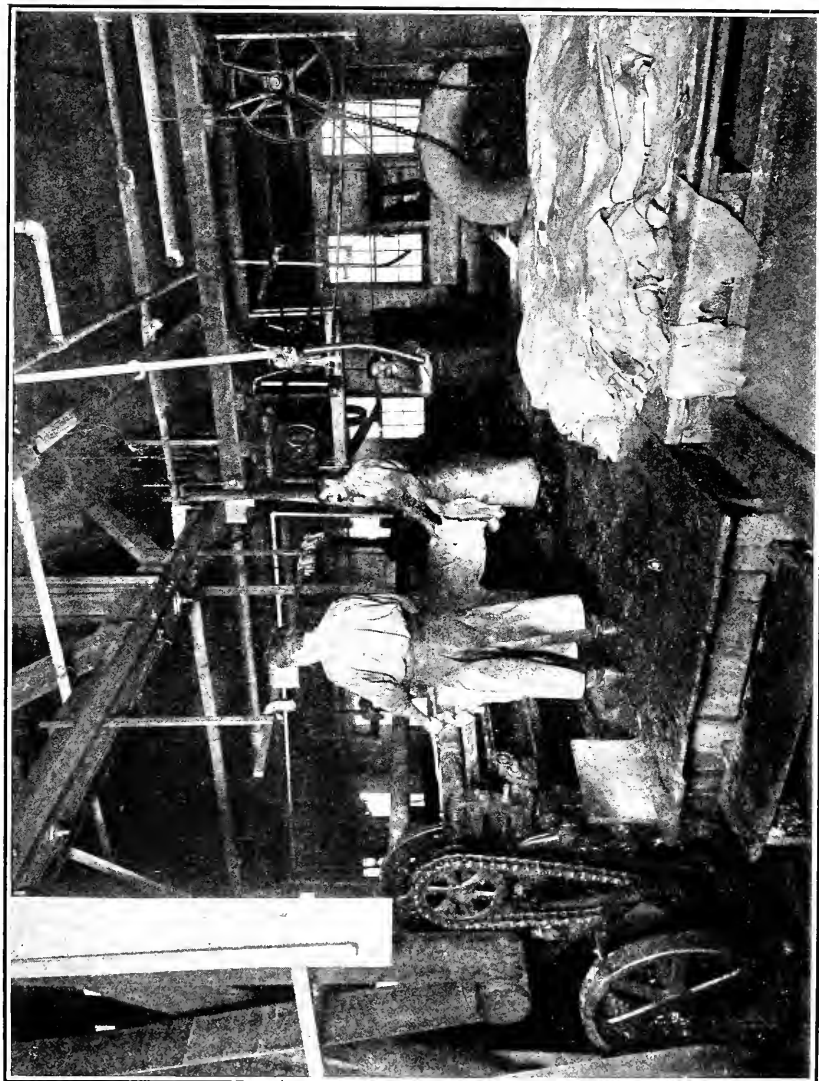


PLATE 11.—"FLESHING" HIDES BY MACHINE.

No. 8, of Pierceton, Ind., died at the age of 52 on April 1, 1910, of "anthrax; heart failure." His occupation was law and farming, and death followed within five days, the physician states, after "bite of fly." A carbuncle appeared on the cheek, with "papules, pustule, vesicles, great induration." Phenol (carbolic acid) was injected and stimulants were given. When asked whether antianthrax serum was injected the physician replied: "No; none to be had."

No. 9, of Reading, Pa., died at the age of 49 on April 22, 1910, of "anthrax." According to the physician the patient "was the mother of a large family, and a hard-working housewife. She claimed to become infected through an abrasion of the skin of the back. She was treated in the beginning by domestic remedies. When I saw the case the patient was so weak and the slough so large that I made no attempt at excision." Her husband states that the deceased had been a cigarmaker for a few years before her marriage.

No. 10, of Wilmington, Del., died at the age of 17 on June 4, 1910, of "anthrax." He was employed at \$1.75 a day by a large morocco firm and came in contact with goat skins imported from South America and from China. The skins, according to the physician, were washed, but not disinfected, before the boy handled them; hot water, gloves, nailbrushes, and disinfectants were provided for the workers. Bloodstained materials were eliminated "as far as possible," but there was no special ventilation. The illness lasted four days. "When he sent for me," declares the physician, "I found the pustule on his right chest, which, with the history of his working in the morocco factory, I decided was probably anthrax. A slide confirmed it." That is, anthrax bacilli were found by microscopic examination. "The course was very rapid," continues the medical man, "the people poor and could not afford serum treatment, and he died. I cut out the pustule, but it did him no good." No indemnity was received by the family for the boy's death.

No. 11, of Latrobe, Pa., died at the age of 34 on June 29, 1910, of "anthrax; septic intoxication." He was a laborer in a paper mill, his duties, according to one who was connected with the mill at the time, being to unload baled rags from cars and to truck them into the storage sheds and to the cutting room, where the rag cutters would cut the bales open and feed the rags into the cutting machines. The rags were principally cotton, coming in the main from "all parts of the United States and Canada," but occasionally as many as "50 cars of foreign rags" would arrive at one time from England, Germany, France, Ireland, and Spain. The rags were "never treated with any disinfectant" or cleaned. This man's work was done in the open air, on a platform which was "cleaned as often as needed." No hot water, gloves, nailbrushes, or disinfectants were provided; in fact, says the informant, "there has never been any precaution taken in regard to the prevention of disease." The man went for treatment to a hospital in Greensburg, Pa. The physician in charge of the case states that the clinical symptoms were so typical that he holds the case was one of anthrax. "Two of my colleagues who saw the case with me are of the same opinion. The man had a virulent infection above the ankle. There was at this point a circular area, probably 2 inches in diameter, much reddened and elevated, with a rather clear serous and somewhat depressed center. There was a marked lymphangitis extending up the leg and thigh. The man was profoundly toxic and had a high temperature range. When the diagnosis was made, which was very soon after his admission to the hospital, he was removed to a tent which I had erected in the yard, and there he died during the night following admission." The duration of the illness was 10 days. Antianthrax serum was not available for injection.

No. 12, of Howe, Pa., died at the age of 52 on July 19, 1910, of "anthrax; skinning a cow dead with the disease." The man's occupation is given merely as "laborer." Illness lasted five days.

No. 13, of Philadelphia, Pa., died at the age of 60 on August 8, 1910, of "anthrax; bronchitis." The disease lasted eight days. The patient was a widow. No occupation is given on the death certificate.

No. 14, of South Hadley, Mass., died at the age of 15, on August 20, 1910, of "general sepsis; anthrax." According to the physician, he was employed at \$1.35 a day as bleach boy in the rag room of a paper mill, but some time after the occurrence the superintendent of the mill is reported to have asserted that, while the boy "had access to the rag room and was probably there, he was not supposed to be there." The physician states that, although the rags used were imported from France and Italy, they were "all new clippings." The physician's story indicates infection through a scratched arm. "On Saturday night, August 13," he says, "patient slept out of doors in a tent." The next morning he "noticed an 'insect bite' on middle of left forearm which was swollen and extremely itchy." On Monday he returned from work "in the middle of the forenoon, feeling sick. Had a chill, nausea, and vomiting." The physician saw the patient first on Wednesday afternoon. He "had some fever and increased pulse rate." On the left forearm was a small localized swelling that looked like a boil; "rest of arm was normal, but left axillary glands and the whole left chest wall was swollen. Patient had an extremely septic look." Under local treatment and catharsis the patient apparently improved for one day, but Friday morning he was worse. The swelling was opened, and a very small amount of pus obtained. "Friday night patient was very restless and looked very sick. Temperature and pulse were both high, and patient was vomiting. Saturday morning patient was in a state of collapse—subnormal temperature, and radial pulse absent until stimulated with strychnia and camphor. Skin was a dark livid red, cold, and covered with sweat. Was still vomiting and passing black urine. It was not until now that I suspected anthrax." The patient was removed to a hospital in Holyoke, Mass., and a consultant called. "Excised localized area (about 2 inches in diameter) and swabbed surface with pure carbolic acid followed with alcohol. Swelling involved only the skin and subcutaneous tissue. Patient died Saturday night." The excised specimen was sent to Harvard for diagnosis, and the report was anthrax.

No. 15, of Maple Hill, Kans., died at the age of 46 on October 2, 1910, of "anthrax." He was a ranch foreman, and according to the physician's statement "infection was through the skin in the forearm," where the man "had a little abrasion." Three or four days before the disease broke out he "helped to skin and take care of a dead cow," and it is supposed that he "got the infection at that time." Death occurred in a hospital at La Junta, Colo., after five days' illness, the disease taking the form of "malignant anthrax edema."

No. 16, of Fairport, Ohio, died at the age of 4 months 11 days on October 13, 1910, of "cramps—disease of bowel; anthrax." How this infant girl contracted the disease the physician was unable to state.

No. 17, of Baltimore, Md., died at the age of 62 on December 2, 1910, of "toxemia; anthrax." He was employed at mixing animal hair in machines, preparatory to spinning. Illness was fatal after two days.

No. 18, of Pomona, Cal., a retired farmer, died at the age of 72 on December 8, 1910, of "anthrax; senility," according to the official death certificate.

No. 19, of Newcastle, Pa., died at the age of 78 on December 19, 1910, of "anthrax; exhaustion following the disease." The deceased was a baker, and death occurred in a hospital after an illness of one month's duration.

No. 20, of Breesport, N. Y., died at the age of 46 on December 22, 1910, of "anthrax, external, and general toxemia." He was employed by a leather company and handled hides, which the physician thinks were imported from Australia. For the purpose of treatment he was taken to Elmira, N. Y. "The local lesion," says the doctor, "was single and situated under the lower jaw, about over the submaxillary gland. Undoubtedly infection gained access through abrasion of the skin at that point. He rapidly became toxic and unconscious and died within a few days from onset of constitutional symptoms. The local symptoms were first papular, then rapidly vesicular, with an area of cellulitis, and soon local gangrene."

No. 21, of Fresno, Cal., died at the age of 52, on December 28, 1910, of "anthrax followed by septic abscesses and pyemia." His occupation is given as barber.

No. 22, of Kittery, Me., died at the age of 24, on December 29, 1910, of "septicemia with malignant pustule." He was a farmer, but the mode of infection could not be ascertained. The physician states that he displayed "all the typical clinical symptoms." Death occurred after three days' illness.

No. 23, of Canastota, N. Y., died at the age of 75, on January 27, 1911, of "anemia; malignant pustule, right cheek." For much of his life he had worked as a cigar maker, but at the time of his death had retired. Anti-anthrax serum was not available.

No. 24, of Waterford, Vt., died at the age of 29, on February 28, 1911, of "anthrax." He did farm work about the neighborhood. According to the physician, eight days before the man's death "malignant pustule" appeared in the form of "pimple on face," contracted by "contagion from a sick cow." Curative serum was not available. There were no dependents.

No. 25, of Harrison, Ind., died at the age of 62, on April 28, 1911, of "anthrax; septicemia." His occupation is given as "laborer." Illness lasted, according to the official death certificate, 21 days.

No. 26, of Youngsville, La., died at the age of 34, on April 28, 1911, of "anthrax." Deceased was a farmer. The record at the New Orleans hospital to which he was sent furnishes these data: "Patient admitted to ward in delirious state. Was unable to give coherent account of illness. Friend, who accompanied him to hospital, said that eight days prior to admission a small sore like a boil appeared on bridge of nose (this told him by patient's wife). The inflammation process spread rapidly and involved the skin of forehead and both eyelids, together with some of the skin covering cheeks, in a gangrenous process with necrosis and sloughing pustules here and there. Patient gradually grew worse and died." The eyes were "closed by exudate from skin lesion," and "punched-out ulcers with undermined edges" were found on nose and forehead. Anthrax bacilli were found. The patient had skinned a dead cow some time before he became ill.

No. 27, of Windham County, Conn., died at the age of 72, on May 7, 1911, of "anthrax." He was a self-employing tailor, and was partially supported by an Army pension of about \$12 a month. His work consisted of "mending and pressing old clothes," states the physician. No antianthrax serum was available.

No. 28, of New Britain, Conn., died at the age of 52, on May 16, 1911, of "anthrax (malignant pustule); septicemia." Her occupation is given as housekeeper.

No. 29, of Lynn, Mass., died at the age of 38, on May 30, 1911, of "anthrax; pulmonary tuberculosis." His occupation is given only as laborer. From the hospital record it is learned that the patient went to the accident room "with

a small red spot on right cheek which he had had for two days." There was also small swelling and redness around the spot. A "slide was taken and anthrax bacilli found." The patient, however, refused treatment and went home, saying he would return in an hour. He did not go back until the following morning, when the spot had "increased in size, swelling greatly increased, and some edema." Excision was then performed under ether, the wound cauterized with carbolic acid, and corrosive poultices applied. The man died on the fourth day after first applying at the hospital.

No. 30, of Cleveland, Ohio, died at the age of 40, on June 21, 1911, of "malignant pustule; edema of glottis." He was a traveling musician, "with a circus" at the time of infection, the physician is sure. While in a Pennsylvania city he "had a small infection on upper lip which he squeezed; following this the infection rapidly involved the whole upper lip, and he was advised to hurry home." When called the physician "recognized a very severe infection with rapidly extending edema involving cheek and eye, temperature 105°, with extremely rapid pulse." Treatment consisted in local injections of carbolic acid, ichthyol applications to his face, which was edematous, with temperature baths and supportive treatment; medication mostly by hypodermic injection. "A strong attempt was made to get anthrax vaccine, locally and by telegraph." One firm sent a supply through a local representative, "but patient died before application could be made." The history of the patient's "traveling with the circus, his fondness for horses (by his own statement), the initial lesion with extremely rapid progress of disease, characteristic pustule, gangrenous, vicious appearing ulcer, high temperature, and rapid disintegration," are considered by the physician convincing evidence of anthrax.

No. 31, of Monterey, Cal., died at the age of 38, on July 10, 1911, of "anthrax; acute uremia." The statement of occupation is merely "laborer."

No. 32, of Dubois, Pa., died at the age of 38, on July 28, 1911, of "anthrax; anthrax edema." Under the head of occupation the death certificate says, "None."

No. 33, of Bakersfield, Cal., died at the age of 42, on October 16, 1911, of "anthrax." The woman lived on a farm 16 miles from town. A pustule broke out on her neck, but she paid little attention to it for 10 days, when she called a physician, who pronounced it anthrax. "It seems," says the medical man, "a sheep had died in the neighborhood, and as there was an abundance of flies in the house there is no doubt that the infection was carried by the flies." Death occurred on the fifth day of treatment. There were two dependents.

No. 34, of Philadelphia, Pa., died at the age of 38, on November 7, 1911, of "anthrax; due to bacillus anthracis." His occupation is given as laborer.

No. 35, of Wilmington, Del., died at the age of 48, on November 20, 1911, of "anthrax." For two years previously he had been employed as an assorter of hides in a morocco works, at \$1.20 a day. The hides were imported in a raw state, and, according to the physician, were domestic cleaned, but the cleanliness of the workroom was "not what it should be" and no gloves or nail-brushes were provided. The patient "showed all the symptoms of anthrax"; no test for bacteria was made. Antianthrax serum was injected, but "too late." The wife and four dependent children received no indemnity beyond funeral expenses.

No. 36, of New Orleans, La., died at the age of 25, on December 27, 1911, of "anthrax (carbuncle); malignant pustule." He was a salesman for an electrical supply house. The attack lasted 10 days, appearing first, the hospital physician says, as "infection on upper lip, right side." It then "spread to nose and face of same side; subsided after drainage and cauterization, followed by

ichthyol dressing." The final symptoms were "rapid invasion of other side of face, neck, chest, pharynx, etc." Serum treatment was not utilized.

No. 37, of Logan County, Ky., died at the age of 51, on February 3, 1912, of "malignant pustule; heart paralysis." The woman's occupation is not given on the official death blank.

No. 38, of Philadelphia, Pa., died at the age of 52, on February 6, 1912, of "anthrax." He was a bristle comber and hair dyer, earning \$1.50 a day, and the materials he worked with came from Siberia. The illness lasted seven days, but the doctor in the case states that the man "had no physician until the day before his death, when I was called in to attend him." Six days before he had noticed a pimple on the back of his neck, but "thought it of little consequence, working every day and using antiphlogistine, and in fact intended to work the day before his death, but feeling very sick he sent for me." On examination the physician found on the back of the patient's neck what at first seemed to be a carbuncle, but closer observation proved it was not one. It was probably anthrax. The man was "suffering severe pain and had every evidence of septic infection." A few hours later excision was performed, which the patient said gave him great relief, "as if a bar of iron had been removed from his neck." The following morning the physician "was called early and found him in extremis." Examination of the specimen removed showed anthrax.

No. 39, of Mesopotamia, Ohio, died at the age of 30, on February 13, 1912, of "malignant pustule on right side of face; abscess of right kidney." She was a housewife, and the physician's history shows a long period of neglect of initial symptoms, "as her people were strong Christian Scientists." When a medical man was finally summoned he found a temperature of "about 103½°", pulse 110; patient went from bad to worse, until death finally ended the scene."

No. 40, of Philadelphia, Pa., died at the age of 47, on March 2, 1912, of "anthrax." Death occurred in a hospital. The man's occupation is given as haddresser.

No. 41, of Wilmington, Del., died at the age of 19, on March 6, 1912, of "anthrax." He was a morocco worker, probably in the beam house. The pustule appeared at the angle of the jaw, and caused death by strangulation in 48 hours.

No. 42, of Toledo, Ohio, died at the age of 57, on March 7, 1912, of "exhaustion from chronic cystitis; blood poisoning; anthrax, malignant pustules on leg and hand." Nothing more definite than "laborer" is given as his occupation. Death occurred in a hospital.

No. 43, of Boston, Mass., died at the age of 26, on March 9, 1912, of "septicemia; anthrax." He was a longshoreman, and for some time preceding the date of infection had been handling hides. The assistant superintendent of the hospital where he died on the day after admission and three days after the beginning of the attack states that the disease took the form of a "small pimple, increasing until sides of face became swollen." Examination disclosed "very numerous, very large bacilli—bacillus anthracis." Treatment was by excision of a "wide area about pustule."

No. 44, of New York, N. Y., died at the age of 18 on June 2, 1912, of "malignant pustule." As far as the physician can recollect she was a school-teacher, "well developed, and in good physical condition, with a previous good history." She had been "bit by a mosquito on the left cheek immediately below the mouth." On the following day there was observed a "hard, tense swelling," which in three or four days became "much worse, much bigger, and exceedingly

painful." The mass was opened, but as there was no improvement a second and more extensive operation was performed the next morning. "The patient was given appropriate vaccine treatment and everything was done for her, but she died on the following day."

No. 45, of Cincinnati, Ohio, died at the age of 81 on July 23, 1912, of "anthrax or carbuncle; septicemia and asthenia." He was a retired pilot.

No. 46, of Allegheny County, Pa., died at the age of 55 on August 6, 1912, of "anthrax." The physician who made out the death certificate gave the occupation as foreman, but did not state in what kind of an establishment he worked.

No. 47, of Orange, N. J., died at the age of 52, on September 13, 1912, of "inoculation by anthrax bacilli, causing general systemic poisoning." He was a veterinary surgeon, and the medical record of the case is so clear and striking that it deserves to be quoted at length. When the patient first went to secure medical advice he had, reports the physician, "a brownish spot at his left wrist about the size of a wart, and his left forearm was swollen and edematous up to the elbow. He gave a history of performing an autopsy on some cows about 12 days or more previous to seeing me, at which time he scratched his right forefinger, but at once cauterized it. Nothing developed at this spot, but it seems probable that he must have scratched himself on the left wrist at the same time without knowing it." However, "no symptoms of any kind developed for at least a week or more after the autopsy, and I think it was nearly two weeks afterwards that he first saw me. That morning (September 9) he walked into my office not looking sick and with a normal temperature and pulse, and his forearm, though swollen and tense, was not angry looking." The physician did not know what to make of his condition and immediately consulted two other surgeons, who agreed with him that "there was evidently some form of infection, but none of us knew what it was." The patient was consequently taken to a local hospital, where the pathologist took a culture from the "wartlike brownish spot at the wrist" and reported next morning that the culture "showed anthrax bacilli." By this time the swelling had "extended 2 inches above the elbow, and the spot at the wrist was as big as a quarter." A physician from a large New York hospital was called in consultation, who advised that a few drops of blood from the patient's right ear be taken for examination. This was done, "and the slide showed anthrax bacilli, which indicated that the bacilli were then in the general circulation." The patient was again taken to the local hospital, where that afternoon the New York practitioner operated, cutting out the original focus at the left wrist and making long incisions in the arm and forearm. No pus was found, but the incisions were made to relieve the tension and promote drainage. Though this operation was performed within 30 hours after the patient first presented himself for treatment, there was little hope that it would save him, as the bacilli were all through the system, as evidenced by the blood taken from the lobe of the right ear. "A Philadelphia firm supplied through special messenger some anthrax serum made in Italy (I believe), and this was injected subcutaneously in large doses and repeated at intervals. No instructions were given at first as to the method of injection, but latterly the serum was injected directly into the veins as advised. In spite of all that was done, the patient gradually grew weaker and died quietly in bed September 13, 1912." The infected spot, adds the physician first consulted, "was unlike anything I have ever seen, and its extraordinary development within 24 hours was a sight not likely to be forgotten."

No. 48, of Stoddard County, Mo., died in Richland, Mo., at the age of 59, on October 14, 1912, of "anthrax." Deceased was a farmer.

No. 49, of Philadelphia, Pa., died at the age of 34 on November 14, 1912, of "anthrax." The man was a laborer in a tannery and was admitted to a

hospital on the fourth day of the attack with "anthrax lesion on neck." He died the following day, leaving a widow.

No. 50, of Peabody, Mass., died at the age of 20, on November 18, 1912, of "anthrax." He had worked for about a year as a "lumper" in the coloring room in a morocco and calfskin tannery, at \$1.50 a day. According to the hospital physician there was no special ventilation, but the workroom was cleaned daily and hot water was provided, also bichloride of mercury as a disinfectant. The disease took the form of "pustule, immense swelling." The pustule was cut out under local anesthetic, but death resulted suddenly from "embolism; blood vessels obstructed at site of swelling." From the industrial accident board which administers the workmen's compensation act in his State it was learned that the pustule appeared on the right breast. On November 18 the man "told the foreman when he went home at night that he felt sick." Two days later he called a physician, and he was removed to the hospital, where he died next morning. The man was married, and his dependents were entitled to compensation, but lived in Europe and the accident board was unable to locate them.

No. 51, of St. Paul, Minn., died at the age of 7, on November 20, 1912, of "malignant pustule; blood poisoning." The patient was a schoolgirl, and the hospital authorities "do not know how the disease was acquired." Illness lasted 14 days; antianthrax serum was not available.

No. 52, of Graves County, Ky., died at the age of 17, on December 4, 1912, of "anthrax." She was a housekeeper.

No. 53, of Ballard County, Ky., died at the age of 28, on December 23, 1912, of "anthrax." Her occupation is given as housewife.

No. 54, of Wilmington, Del., died at the age of 39, on January 19, 1913, of "malignant pustule." He was a stationary engineer in a large morocco works.

No. 55, of Philadelphia, Pa., died at the age of 30, on January 23, 1913, of "anthrax carbuncle of neck." He had worked for only eight months at the establishment where he contracted the fatal infection. The uncle with whom he lived states that he complained of having a painful neck two days before he called a physician, death occurring within the succeeding 24 hours. The coroner's inquest developed the following information: Deceased earned \$9 a week working as a laborer about a factory where "curled hair was handled." Most of the hair was imported from Russia, South America, and England. The firm stated that "the usual precaution, by sterilizing the hair, had been taken." According to the coroner the firm "supplies freely serum imported from Italy," but the man and his uncle, "apparently, neglected available means of treatment until too late."

No. 56, of Philadelphia, Pa., died at the age of 55, on February 13, 1913, of "anthrax." He was a longshoreman, and seven days before death had loaded hides and wool. First symptoms appeared seven days before death, in the form of "pimple on right cheek." On the day of his death the patient was ordered removed to a hospital, but died before the arrival of the ambulance.

No. 57, of Snohomish County, Wash., died at the age of 58, on February 15, 1912, of "anthrax of right hand." She was a housewife.

No. 58, of Gloversville, N. Y., died at the age of 37, on March 1, 1913, of "anthrax; edema of glottis." Deceased was by trade a molder in a foundry, but at the time of contracting the disease had been employed about six months in a leather-dressing establishment, liming skins and as general helper. Here, according to the official occupational disease certificate, he "had been helping store away raw sheepskins, and picked small pimple on side of neck." The chief symptoms were "papilla (small) on left side of neck over tonsil, chills.

moderate fever, 101° - $102\frac{1}{2}^{\circ}$; rapid pulse, 120-140; edematous swelling about head, neck, and chest." The swelling was "extremely rapid," and the physician elsewhere states that "within 24 hours it involved all the lymphatics of the neck and axilla." Anthrax bacilli were found, but protective serum was not available. Death occurred in four days. The sheepskins the man handled were imported from South America and from Africa, and were frequently blood-stained. Bloodstained materials were not eliminated, and were disinfected only by the "tanning solutions, lime, naphthalin, etc." The cleanliness of the workroom is described as "generally good" by the physician, who further states that hot water and disinfectants were furnished to the men, but no gloves or nailbrushes. The wife received a small indemnity.

No. 59, of Brooklyn, N. Y., died at the age of 46, on April 6, 1913, of "anthrax of the neck; fatty degeneration of the heart." Deceased was a druggist, and the physician who attended him was unable to determine the manner of contagion, but found anthrax bacilli and a true anthrax pustule. Treatment was by "antiseptic solution and antiseptic dressing."

No. 60, of Gardner, Mass., died at the age of 33, on April 12, 1913, of "anthrax infection of face." The man was a chair maker, and the physician states that he "could find no history of contact with hides, leather, wool, or animal matter." Nevertheless, anthrax bacilli were found. April 5 he squeezed a small pimple on the right side of his lip, and it immediately began to pain and swell. He was seen by a physician on April 7, when he had a "congested pimple on upper lip" and "temperature 104° ." Two days later he returned to the physician, with "extreme inflammation of side of face, hardened area with carbuncle appearance." The following day he was taken to a hospital, where he died within 48 hours. Antianthrax serum was not available.

No. 61, of Cascade, Pa., died at the age of 34, on May 2, 1913, of "anthrax." He was a freight agent, and the physician states that "infection was caused by handling foreign hides."

No. 62, of Racine, Wis., died at the age of 33, on May 5, 1913, of "malignant pustule on face, also internal in mouth; edema of glottis." The woman was a domestic servant.

No. 63, of Philadelphia, Pa., died at the age of 25, on May 9, 1913, of "anthrax." The man was a haircloth maker. According to a local newspaper he felt ill after working over "a bale of hair from Siberia," and went home. "Shortly afterwards, apparently slightly better, he went for a walk with his wife. Then came a sudden seizure which laid him unconscious in the street." A physician had him sent to a hospital, but "he died on the way." The paper further states that the home was placed under quarantine. The hospital physician describes the symptoms as "anthrax lesion of left cheek."

No. 64, of Wilkes-Barre, Pa., died at the age of 4 months, on May 28, 1913, of "malignant pustule." The physician states that he was called in on May 24 and found the baby girl with a "brawny swelling about 1 inch in diameter on the left side of the face just above the lip." Thinking it was an insect bite or an ordinary boil, he gave an antiseptic wash, but on calling the next day he found the swelling "had extended up to and was closing the eye, and skin was of a dark purple color; fever quite pronounced." The mother then stated that she suspected the infant had been struck in the mouth with a fly swatter by an older child. The abscess grew until it involved the whole left side of the face, and then opened spontaneously. Large quantities of pus were discharged. The physician states positively that, "while no microscopic examination was made, the clinical symptoms clearly pointed to infection by anthrax bacillus."

No. 65, of Hennepin County, Minn., died at the age of 16, on July 17, 1913, of anthrax. The boy was the son of a small berry farmer, and helped to cultivate the berries and also to care for the cow and horse. The boy first complained of pain between the shoulder blades, and believed an insect had bitten him. When he consulted a physician two or three days later the latter "told him it was a big carbuncle, as it had all that appearance," and ordered 24 hours' poulticing. "When he came back," says the doctor, "I opened it, making a cross incision to the bottom of it, then with iodized phenol thoroughly cauterized it out and dressed it with antiseptic gauze." Three days afterwards the boy came back, "having considerable temperature" and "more pain." The lesion was curetted out, cauterized again, and then dressed twice daily, but "the malignancy kept spreading, delirium developed, as well as all the marked symptoms of blood poisoning." A consultant was called, who pronounced the case anthrax. "No matter how thoroughly the gangrenous parts were cleaned out and strong antiseptics used, it kept extending. Temperature kept going up until it reached 107°." No laboratory examination was made, but the attending practitioner states that the case "was pronounced anthrax by two physicians."

No. 66, of North Attleboro, Mass., died at the age of 76, on July 20, 1913, of "malignant pustule." She had been acting as housekeeper and nurse for one of her daughters in a neighboring town who, according to her own family physician, died of puerperal sepsis. While so engaged the woman "scratched her finger on a nail in cellar stairway," and was seized with "chills" and "high fever." Two days after returning to her own home the woman called a physician, who found her arm swollen and "of dark purple," fever 104°. "Next morning small pustules appeared on the whole extent of limb, and glands of axilla appeared to be a whole solid mass." General treatment was administered to reduce the fever, three incisions were made the entire length of the arm, and a wet bichloride of mercury dressing (1 to 3,000) was applied. Death occurred on the fourth day of treatment. The physician states that in his opinion "infection was due to inoculation with bacillus anthracis."

No. 67, of Windsor Locks, Conn., died at the age of 49, on August 5, 1913, of "malignant pustule; septicemia." He was a liveryman and the physician states that "it has never been cleared whether the case was anthrax from the start, or if the patient was inoculated with the disease subsequently when, at his request, the small pustule was opened with a penknife in the hands of a relative." The knife had previously been used by the patient in incising what he thought was an "abscess" on one of his horses, but had disappeared before the reporting physician took charge of the case. The disease lasted five days, appearing as "pustule on upper lip, profound toxemia from start." Bacteriological examination was not complete, but antianthrax serum was injected. Local treatment was by incision, drainage, and antiseptic applications.

No. 68, of Brighton, Pa., died at the age of 34, on August 13, 1913, of "anthrax." She was a housewife, and the physician states that the "symptoms convinced him as to bacillus anthracis."

No. 69, of Wilmington, Del., died at the age of 54, on August 23, 1913, of "anthrax." He was employed by a large morocco plant.

No. 70, of Lincoln, Mo., died at the age of 28 on September 8, 1913, of "anthrax; metastatic pneumonia." Deceased was "a robust, rugged young farmer." On September 3 the physician who was called to examine him found "a large vesicle at the seat of infection" on the septum of the nose, and "several small vesicles on the external part of the nose." The disease had then been progressing two or three days, and the whole nose was "of a very dark color and badly

swollen" and one eye was "swelled shut." The nose was gangrenous in appearance, "and also in fact, as when I cut the nose with my knife he did not have any painful sensations." Temperature at the first visit was 99°, pulse 90, "and not a great deal of constitutional disturbance." On September 4 there was little change, "except that the gangrenous condition had extended to the left cheek." The following day, however, "he had a severe pain in the left side, temperature 101°, dullness on percussion over the lower lobe of left lung, bloody expectoration, crepitant râles on auscultation, and a further extension of the gangrenous condition of the face." On the 6th there was less pain in the side, but the gangrenous condition on the face was "still spreading." By the 7th the right lung had become involved, there was "considerable difficulty of breathing, pulse rate greatly increased in frequency; gangrenous condition at this time extended below the angle of the jaw." On September 8 all the symptoms had become more severe, and when last seen by the physician he was "going into a state of collapse and died in a short time. Anything I did for him did not check the progress of the disease in the least, and had he not been of a very robust constitution would have died sooner than he did." None of the pathological specimens were examined microscopically, but from the clinical symptoms the doctor has no doubt that he had "to deal with a very severe case of anthrax."

No. 71, of Gates, N. Y., died at the age of 16, on September 29, 1913, of "splenic fever; malignant facial anthrax." The physician states that the boy "chored around home," and that the source of the infection is unknown. "Pustule appeared on lower lip, spread rapidly over whole left side of face; chills, enlargement of spleen, high fever, gastroenteric hemorrhages and meningitis; died in coma."

No. 72, of Elyria, Ohio, died at the age of 67, on October 7, 1913, of "anthrax; chronic nephritis." He was a physician.

No. 73, of Unity, Pa., died at the age of 1, on October 22, 1913, of "cholera infantum and anthrax." The physician states that the child, a girl, was ill about three weeks. He did not think it necessary to make a microscopic examination, but is certain case "was due to inoculation with bacillus anthracis." Protective serum was not available. The family, he declares, was "very unclean, and child could have contracted the disease by toying with a diseased dog or cat, or from partaking of milk or butter, or through the agency of flies or insects, or by inhaling dust containing the virus."

No. 74, of Elkland, Pa., died at the age of 52, on October 23, 1913, of "anthrax; infection upon the neck." He handled hides in a tannery, receiving \$2 a day. The hides were imported from South America and China. Bloodstained materials were not eliminated at the plant, the physician says, and he does not think disinfection was carried on or that gloves or nail-brushes were furnished. The man sought medical assistance only when it was "too late for human aid." He was taken to Lycoming County. Anti-anthrax serum was obtained in Philadelphia and freely used, but the disease had already progressed too far, and he died on the sixth day of the attack. The company paid the funeral expenses and offered the widow \$500 in settlement, which she refused. The lawyer in whose hands she put the case secured a judgment for \$300, out of which he charged a \$90 fee. Apparently the suit dragged until the beginning of 1916, for the widow states that "they are now paying me \$10 per month" since January 1 of that year.

No. 75, of Hanford, Cal., died at the age of 33, on November 11, 1913, of "anthrax." He was a ranch laborer, earning \$2 a day. First symptoms appeared on November 6, but a physician was not called until the 9th. At that time, says the latter, "the face was swollen on right side over antrum

and was quite tender to pressure. Tenderness on canine and bicuspid teeth was shown when pressure was made. Eyelid edematous and red. Diagnosis at that time was made as abscess of antrum, and operation for draining was advised." The same evening the floor of the antrum was perforated under ether "and a dark, bloody discharge escaped." The patient regained consciousness, but the next morning the swelling had greatly increased on right side, closing the eye and assuming a dark purplish hue. The left side of the face became involved. Bloody secretions drained from nose on right side and from opening draining the antrum. "A peculiar odor from the patient caused me to associate it with the odor I had noted in a cow dying from anthrax. Specimens taken from secretions of nose and antrum each showed the anthrax bacillus in large numbers. At noon on the 10th the patient became unconscious. Patient died at 3 o'clock on the afternoon of the 11th." Death occurred in a sanatorium.

No. 76, of Boston, Mass., died at the age of 23, on December 13, 1913, of "anthrax; toxemia." Deceased was a longshoreman. From the hospital record it is learned that two weeks before admission he "handled South American hides," and three days before admission he "handled American hides." Four days before he entered the hospital a "pimple appeared on his right neck below the angle of the jaw. Several blebs appeared later around the pimple which broke down. Pain and swelling with redness and induration followed." At the time of admission the patient presented "a small brown ulcer on right side of neck one-third inch in diameter, surrounded by a circle of white blebs near by. Considerable edema of whole right side of neck extending as far forward as point of jaw; temperature, 102°; white blood count, 32,400." A circular excision was made and swabbed out with iodine; forced nourishment and stimulants were given; corrosive 1/5,000 dressing every four hours. Blood culture was positive for anthrax bacillus. "Edema soon extended down whole right side of chest, turning a dusky red. Patient failed gradually since operation," though suffering little pain. Finally he "became delirious and in a few hours sank into coma and died." The deceased left a dependent mother, but indemnity, which under the Massachusetts workmen's compensation law is paid for cases of anthrax, was refused in this case, because the insurance company contended that the disease was not contracted while the deceased was in the employ of their policyholder, but while working for another company.

No. 77, of Winchester, Va., died at the age of 46, on December 20, 1913, of "blood poisoning, the result of anthrax." He was a barber.

No. 78, of Union, N. Y., died at the age of 56, on December 24, 1913, of "anthrax infection." The disease took the form of "anthrax edema"; it "developed on the face; advance was very rapid to extensive involvement of face, head, and neck"; diagnosis was made on the third day and was confirmed by the State laboratories. The deceased was a farmer, and, according to the physician, "was in the habit of buying up old and poorly nourished cattle, butchering them, and selling them where he could. He certainly handled diseased meat." At the time of his death he was awaiting trial for selling tuberculous meat. "The hired man," continues the doctor, "says he has gone home at night leaving a very sick cow in the stable and found in the morning a beef dressed and the sick animal missing. No questions were asked or answered in regard to it." It therefore seems to the physician "likely that infection took place during, or as a result of, his occupation as a handler of domestic beef, and that often diseased."

No. 79, of South Windsor, Conn., died at the age of 14, on January 16, 1914, of "anthrax or malignant pustule; toxemia." The girl had no occupation. The illness lasted 10 days.

No. 80, of Camden, N. J., died at the age of 47, on January 29, 1914, of "anthrax (malignant pustule)." He had been employed for eight months as a checker and receiver of horse hides imported from Russia in an establishment where leather was tanned and finished. Diagnosis was made on the second day of the illness. The pustule was located under the right ear. The physician also found edema of upper chest, rapid pulse, cold extremities, no pain, and no complicating conditions. Serum treatment was used, but with no improvement. The illness lasted four days. Previous to entering the occupation which caused his death he had been an undertaker.

No. 81, of Fremont, Ohio, died at the age of 52, on March 9, 1914, of "rheumatism and anthrax; pericarditis." According to the official death certificate the illness lasted three months. The occupation of the patient is not stated.

No. 82, of Philadelphia, Pa., died at the age of 30, on March 15, 1914, of "anthrax." "Anthrax bacillus was proved by finding the organism in the discharge from his cervical lesion." The man was colored and worked as a stevedore, and three days before his death he had been "unloading a cargo of hair from China." The physician who examined him at the hospital "found a diffuse swelling of the right cervical region, with evidence of a small pustule which had ruptured and was rather inconspicuous because of the dark surface of the skin. The case was not diagnosed at the time as one of malignant pustule, and an incision for the purpose of drainage was made in the neck." The patient came to the hospital next day, and a number of incisions were made on his neck for the purpose of relieving his respiratory difficulty. "He grew progressively worse, and died in the hospital ward 60 hours from the time he applied for treatment. Our cultures showed the anthrax bacillus in both cultures."

No. 83, of Pleasant Prairie, Wis., died at the age of 55, on March 20, 1914, of "anthrax, general infection." He was a farmer. Physician states that the man opened a cow to ascertain the cause of its death and found in its abdomen black spots, which he dissected. The "pubic region and limbs" were affected. Examination showed "various necrotic areas which rapidly broke down. Scrotum very much enlarged and necrotic." Patient was delirious for two days. The illness lasted seven days.

No. 84, of Calexico, Cal., died at the age of 70, on April 6, 1914, of "septicemia, almost certainly due to anthrax in a cow; died of it a few days ago." The illness lasted five days. The patient was a housewife.

No. 85, of Philadelphia, Pa., died at the age of 38, on April 6, 1914, of "anthrax." She was a housewife.

No. 86, of Norfolk, Va., died at the age of 54, on April 11, 1914, of "anthrax (malignant edema); toxemia." Illness lasted five days.

No. 87, of Philadelphia, Pa., died at the age of 60, on May 6, 1914, of "anthrax." He was a skin washer in a leather factory. Illness lasted four days. The physician at the hospital where he was admitted on the third day of the disease describes the attack as "anthrax lesion on left side of face."

No. 88, of New Orleans, La., died at the age of 3 months, on May 29, 1914, of "anthrax at base of spine; scrofula." He was ill one month.

No. 89, of Philadelphia, Pa., died at the age of 35, on June 17, 1914, of "anthrax." The patient was colored; he worked as a longshoreman, and three days previous to admission to the hospital where he died he was unloading hides. "Two days after that," writes the physician, "a pimple on the face began to swell rapidly, causing little pain. The swelling progressed and involved all the tissues of the neck. Anthrax serum was not used in the treatment."

No. 90, of Cincinnati, Ohio, died at the age of 41, on August 8, 1914, of "anthrax infection of face; acute nephritis." He was a tailor and presser. He became sick on August 2; the first symptom "appeared on the upper lip, where a horsefly bit him while out in the country. Entire face swelled up and was somewhat red and edematous. Both eyes were closed from extensive swelling."

No. 91, of Lewiston, Me., died at the age of 45 years, on August 19, 1914, of "endocarditis, with chronic rheumatism and anthrax." His occupation was given by the official certificate as laborer, and the physician states that his average earnings were \$1.75 a day. The attack is described as "cauliflower on the back of the neck." The treatment given was "cruciform opening and burning with cauter." Serum was not used.

No. 92, of Hollidaysburg, Pa., died at the age of 18 years, on September 10, 1914, of "malignant pustule." She had no occupation.

No. 93, of Wilmington, Del., died at the age of 29, on October 10, 1914, of "anthrax; edema of larynx." He was a morocco worker.

No. 94, of Brooklyn, N. Y., died at the age of 56, on November 25, 1914, of "anthrax; infection bacillus anthracis." The official death certificate designated him merely as "laborer," but from other sources it was learned that he worked in a tannery. "Two days before admission to the hospital patient noticed a small pimple on neck; he said he pinched it; from that time on the neck became more and more swollen. At first there was little pain, but a difficulty in breathing developed just before admission." In the hospital "excision of pustule and incisions of indurated area" were made. The patient died four days later. Anthrax bacilli were "recovered from all organs."

No. 95, of Smithson, Pa., died at the age of 42, on December 8, 1914, of "anthrax." He was a liveryman. He was two days at a hospital in McKeesport, Pa.

No. 96, of Lincoln, Nebr., died at the age of 39, on December 8, 1914, of "septic infection due to anthrax bacillus." Her occupation was given as housewife. She was ill one month.

No. 97, of Camden, N. J., died at the age of 53, on December 31, 1914, of "anthrax." He was a laborer in a morocco factory. The physician, when called in, found the patient dying. Examination disclosed "external anthrax, malignant pustule, high fever, edema of glands and surrounding parts." The illness lasted five days.

No. 98, of Fort Morgan, Colo., died at the age of 1, on March 29, 1915, of "anthrax; measles." The child, according to the physician, was scratched on the leg by the teeth of a small dog with which he was playing. The parents attached no importance to the incident, and did not even wash or cauterize the scratch. Two or three days later, the child was taken, with a badly swollen leg, to the physician, who discovered that a calf had died of anthrax on the farm and that the dog had been getting his meals from the carcass, which had not been burned or buried. "The child was very ill when I saw it first. No serum was available when I recognized the cause of infection. The temperature was high. The secretion from the limb was bloody. No pus. The swelling continued to increase and extended upward to the abdomen. The leg was kept in a wet dressing of bichloride, while stimulants were given internally." A culture in blood serum was made and "a pure culture of anthrax" resulted. The child was ill two weeks.

No. 99, of Dos Palos, Cal., died at the age of 25, on April 3, 1915, of "anthrax; due to bacillus anthracis." He was a farm laborer, and at the time of the attack he handled cattle and cattle hides of local origin. "Patient was taken sick

about March 21, 1915," writes the physician of a hospital in Fresno where the man was taken for treatment. "At this time he was treated by a doctor who made the diagnosis of pleurisy with rheumatism. At the onset he had severe pain in the left side with several chills. This was shortly followed by a swelling of the right ankle, which was quite tender and painful. Patient came under our care on March 28, 1915." In the hospital his case was diagnosed as "pulmonary anthrax, with general blood infection." Local treatment was applied to the pustules, which were situated on the lower eyelid and on the anterior surface of the thigh, and smears from both lesions showed anthrax bacilli. On April 1, 40 cubic centimeters of antianthrax serum were injected intravenously; on the following day a dose of 60 cubic centimeters was given. "This is all the antianthrax serum we were able to secure on the coast," writes the hospital physician. The patient died on the thirteenth day of his illness.

No. 100, of Hartford City, Ind., died at the age of 69, on April 4, 1915, of "malignant anthrax." He was a merchant. The physician in charge stated that this was a case of "infectious febrile disease due to the inoculation into the hand of the anthrax bacillus. Death being due to obstruction of circulation by these bacilli; much subcutaneous edema near the inoculation wound, and also metastatic lesions."

No. 101, of Williamsport, Pa., died at the age of 53, on April 25, 1915, of "anthrax causing edema of larynx; facial anthrax." Occupation is given merely as "laborer."

No. 102, of Coudersport, Pa., died at the age of 31, on May 12, 1915, of "internal anthrax; typical case true anthrax." His occupation is given as laborer.

No. 103, of Coudersport, Pa., died at the age of 29, on May 18, 1915, of "septic infection; typical case true anthrax." For several years he had been employed at about \$1.60 per day as a laborer in a tannery, where sole leather was made. He came in contact with imported dried hides. According to the physician in charge of the case, no sanitary precautions were taken. Not all the hides were disinfected; there was no special ventilation; the workrooms were very dirty. The disease took the form of a pustule on the neck. At the hospital, where the patient was taken, excision was performed and carbolic acid was injected around the affected area. Serum was not available; the illness lasted six days.

No. 104, of Nunda, N. Y., died at the age of 14, on May 24, 1915, of "septicemia; anthrax of back." Physician says "all symptoms point to true anthrax." The disease was not suspected until three days before the boy's death, when diagnosis was made. The patient had high fever and delirium, and the disease developed rapidly. The boy was attending school and choring about the house.

No. 105, of Endicott, N. Y., died at the age of 22, on June 1, 1915, of "septicemia; anthrax." The deceased was employed in a leather factory unloading dry South American and Chinese hides. They were said to have been disinfected. Examination showed "infection on arm and neck, and swollen chest." The hospital physician states that he "injected with 12 per cent carbolic acid and removed infected area." No serum was given. The illness lasted two days. "Positive diagnosis was made after death by bacteriological test of blood and tissue of arm."

No. 106, of Thompsonville, Conn., died at the age of 35, on June 7, 1915, of "anthrax infection; genuine anthrax; from initial ulceration on neck." The anthrax organism was "diagnosed in smear and culture." He was employed in a carpet factory. The physician at the Hartford hospital, where the patient

was taken, states that there was a "pustule on anterior neck, and edema and cyanosis of anterior chest." Serum was not available. The illness lasted six days.

No. 107, of Brooklyn, N. Y., died at the age of 6, on June 29, 1915, of "general asthenia from anthrax infection of nose." "An infectious febrile disease with local symptoms," says the physician, "manifested itself in nose and its accessory and other sinuses; the discharge showed a bacillus having all the characteristics of the bacillus anthracis." The child's illness lasted 15 days.

No. 108, of Charlestown, Mass., died at the age of 50, on July 4, 1915, of "anthrax." Autopsy showed that "he suffered from anthrax septicemia, with associated leptomeningitis and hydrothorax." He was a longshoreman. "Investigation brought out," states the physician of the Boston hospital where the man died, "that on May 25, 1915, he worked in the hold of a vessel laden with dried blood, ground bones, and phosphate, and subsequently to that date assisted in the discharging of dried hides."

No. 109, of New Orleans, La., died at the age of 23, on July 8, 1915, of "acute nephritis; edema of lungs; bacillus anthracis; septicemia." He was a laborer.

No. 110, of Boston, Mass., died at the age of 38, on July 8, 1915, of "anthrax; neck infection with bacillus anthracis." He was unloading dry hides at the wharves. The physician at the hospital where the patient was admitted on the day before his death describes his disease as "septicemia with brawny swelling of right face and neck and bulla formation. No local carbuncle. Blood cultures were positive."

No. 111, of New York City, died at the age of 34, on July 29, 1915, of "anthrax infection of neck." He was a weigher in the United States customhouse and handled skins and hides from South America. His duty was to tear open bales to inspect and weigh their contents. Not all the materials he handled were disinfected, and no care was taken to prevent danger. He had been in the work since 1908 and was earning on the average \$4.50 a day. The physician to whom he applied for treatment performed "excision of lesion and drainage." No serum was used. The illness lasted five days. A portion of the excised tissue was sent for examination to the research laboratory of the New York City Department of Health, which reported: "Microscopic examination of gland removed from neck shows anthrax bacillus in culture and liver of dead injected mice." The physician considered the case particularly pathetic because the widow was "left without means and with three small children," and since the Federal Workmen's Compensation Act of 1908 does not cover the employees of the customhouse, the physician's efforts to obtain a pension from the United States Government for the widow were unsuccessful, as "there appears to be no provision for such cases. It would seem that the Government should make some provision for the ones left dependent through its employment of workers at occupations likely to cause their death." A special bill for the relief of this family was finally introduced in Congress, almost a year after the man's death, but up to the time this report was written the House Committee on Claims, to which the bill was referred, had taken no action on it.

No. 112, of Bountiful, Utah, died at the age of 65, on August 24, 1915, of "anthrax." Death occurred in the farmers' ward of the county hospital at Salt Lake City, after three days' treatment. The man was a carpenter.

No. 113, of Baltimore, Md., died at the age of 20, on August 30, 1915, of "pus tula maligna on under lip; pyemia; anthrax." The victim had no employment; she lived at home with her parents and at the time of her illness was visiting

New York. The first symptoms appeared about August 18. The young woman "had a pimple on her lower lip and, as it annoyed her, she pricked it with a needle. It steadily grew worse," and she went to a hospital across the street. There she was treated as an outpatient for a few days. The diagnosis of anthrax was made on August 25, and then "injections of iodine and other germicides" were made and "constitutional treatment internally" was given. Serum was "not obtainable. The pus filtration was very rapid and spread to the right cheek and neck alarmingly." The physician was unable to find out to what uses the needle had been put with which the patient pricked the pimple on her lip.

No. 114, of New London, Conn., died at the age of 57, on September 3, 1915, of "malignant pustule; convulsions." His occupation is given as printer.

No. 115, of Brentwood, N. Y., died at the age of 23, on September 29, 1915, of "malignant anthrax edema." She was a clerk in the post office. The hospital physician who attended the case diagnosed it as "infection with bacillus anthracis, which bacillus was recovered from the excised papule at the New York City research laboratory. The source of this infection, which was on the side of the neck, was not determined." The physician states, however, that the young woman had "tried on clothing trimmed with fur at various department stores in New York City." The disease took the form of malignant edema, "without pustule except fleabitelike papule." Curative serum was secured from Philadelphia, after unsuccessful efforts to obtain it in New York, and injected both subcutaneously and intravenously. Supportive treatment was also given, but death occurred on the sixth day.

No. 116, of New York City, died at the age of 52, on October 7, 1915, of "anthrax." The first symptom was an "itching sensation on chest." Examination by the hospital physician disclosed "papule on chest, with spreading inflammation over left side of body. Fever and prostration. Both microscopical examination and autopsy proved case to be due to bacillus anthracis." The patient had been working for five years as a laborer and driver and during the week before illness was unloading hides from a vessel. He was ill four days; diagnosis was made on the day preceding his death. No serum was available.

No. 117, of Madison, N. Y., died at the age of 52, on October 12, 1915, of "poison from anthrax; cardiac paralysis." His occupation is not given on the official certificate. The physician stated that death was due to "true anthrax; fever and involvement of the glands."

No. 118, of Riverhead, N. Y., died at the age of 71, on October 15, 1915, of "anthrax." The patient was a retired lawyer and did no work except caring for his own home. The manner of infection was a puzzle to the physicians, as he came in contact neither with nondisinfected material nor with animals. The man was never ill before. On October 8 he first noticed on his face a small lump, which soon became a red itching spot. The disease spread rapidly over his face, it reached the chin and attacked the glands of the neck. On the following day he was taken to the hospital and the disease was diagnosed as anthrax; 130 c.c. of Eichorn's serum were injected during the period of three days, but without avail. Anthrax bacilli were demonstrated.

No. 119, of Blue Earth County, Minn., died at the age of 35, on October 22, 1915, of "external and internal anthrax." The physician's statement gives "diagnosis of inoculation with bacillus anthracis." The patient was a housewife. Her illness lasted 12 days.

No. 120, of Bainbridge, N. Y., died at the age of 24, on November 12, 1915, of "septicemia; probably anthrax bacillus." The deceased was helping on her

father's dairy farm doing housework and milking. The disease was diagnosed as anthrax by two physicians who had seen cases before. The illness lasted 10 days. Serum was not available.

No. 121, of New York City, died at the age of 17, on November 18, 1915, of "anthrax." The cause of the death is further described by the hospital superintendent as "infectious febrile disease due to inoculation with bacillus anthracis." The patient was a candy packer. On November 14 she was taken ill. A physician was called, and found a small gray spot on her chest, which, according to the patient, had appeared five days previously. Within the next three days the spot became red and inflamed and her condition grew so alarming that she was sent to the hospital, where 40 c.c. of serum were injected. The patient died 12 hours later. The presence of anthrax bacilli was proved. Some physicians believed that the patient became infected from a neck piece made of cat's fur. As a result official medical inspectors examined a large number of fur-making shops, mostly on the lower East Side, where the victim bought her fur. The theory was opposed, however, by another group of official medical men, who maintained that infection from cat's fur is exceptionally rare.

No. 122, of Philadelphia, Pa., died at the age of 69, on November 20, 1915, of "septicemia due to malignant pustule on hip; cirrhosis of liver." The duration of the anthrax attack is given as 1 month and 10 days, and the man's occupation is given on the death certificate as "cake baker."

No. 123, of Johnson City, N. Y., died at the age of 49 on November 20, 1915, of "anthrax." He was a laborer in a large tannery. His widow made a claim for indemnity under the New York workmen's compensation law, and from the decision of the State industrial commission it appears that "while being shaved on November 16 his neck was slightly cut with a razor. Shortly after commencing work the following morning his neck began to swell, anthrax germs having presumably entered the cut." On that morning, the widow states, "there was a little white spot in the middle of the pimple which appeared to be festered and appeared as though there was pus in it. I took a needle and pricked it and lifted up the edge of the white part, but no pus was discharged but it bled a little." Next day the patient was removed to a hospital where he died two days later. Smears from the anthrax bacilli were found. The industrial commission agreed that the cause of death was anthrax and that it was contracted from the hides among which the deceased was working. Indemnity was, however, denied on the ground that the cut on the neck through which infection took place was not received in the course of employment.

No. 124, of Lewistown, Mont., died at the age of 16, on November 21, 1915, of "anthrax infection; septicemia." He was a farm hand.

No. 125, of Kings County, Cal., died at the age of 56, on November 26, 1915, from "anthrax on back of neck; exhaustion." He was first reported as a painter but later as a laborer, not having any particular kind of work. His illness was stated by the hospital physician to be "due to infection of bacillus anthracis producing carbuncle and general infection." Stimulants were given but serum was not available. He was ill two days, and died an hour after arrival at the hospital.

No. 126, of New Brunswick, N. J., died at the age of 25, on November 26, 1915, of "cellulitis of neck; sepsis; anthrax; valvular heart disease." Deceased was a laborer and worked in a clay pit. The malady took the form of a large pustule on the neck, which the physician reported was "genuine anthrax." Anthrax bacilli were found. Serum was not available; the illness lasted three days.

No. 127, of Chelsea, Mass., died at the age of 40, on November 27, 1915, of "anthrax; malignant pustule." He was a freight handler at the wharves. "Autopsy showed that he died from anthrax septicemia, the principal anatomical lesions being pustule of the cheek, focal necrosis with hemorrhage of the stomach, jejunum, and ileum; hemorrhage of the cervical and mesenteric lymph nodes."

No. 128, of Winchester, Mass., died at the age of 31, on November 27, 1915, of "anthrax." He was employed in a tannery. According to the physician at the Boston hospital where the man died, it was a fairly typical lesion. A crucial incision was made on the day of admission. "Autopsy showed that he died from anthrax septicemia, the principal anatomical lesions being pustule of the upper arm (incised); enlargement with hemorrhage of the axillary, mesenteric, and aortic lymph nodes; enlargement and softening of the spleen; focal necrosis and hemorrhage of the gastrointestinal tract."

No. 129, of New York City, died at the age of 25, on November 28, 1915, of "malignant anthrax; edema." He was a medical student.

No. 130, of Willington, Conn., died at the age of 9, on December 5, 1915, of "malignant pustule; general septicemia." No bacteriological culture was taken, but according to the physician the case presented a "perfect clinical picture of true anthrax." The girl's occupation is given as "at school."

No. 131, of Brooklyn, N. Y., died at the age of 45, on December 18, 1915, of "anthrax; edema of glottis; acute cardiac dilatation." He was a laborer and handled hides at the docks. On admission to the hospital "he showed two typical punched-out ulcers with escharotic bases, small vesicles surrounding each lesion with marked inflammatory areolae. There was intense swelling and edema of the whole right side of neck extending down to chest. Anxious face, sweating of head, pulse barely perceptible, marked difficulty in respiration and dilated heart. * * * Patient complained of intense general abdominal pain (for which no reason could be discovered on ante mortem examination)." "Smears from lesions of neck showed anthrax bacilli." Serum "could not be obtained in time." He died in 15½ hours after admission to the hospital, the illness lasting altogether three days.

No. 132, of St. Paul, Minn., died at the age of 60, on December 27, 1915, of "malignant anthrax (carbuncle) on back of neck." He was a farmer, and also occasionally did carpentering. When the physician was called he found a "carbuncle on the posterior region of neck." The neck was badly swollen; an "incision was made." The wound was dressed every day. Food and remedies to sustain strength were given and the patient was kept in bed. He was under the doctor's care only three days.

PROBABLE RATIO OF DEATHS TO TOTAL NUMBER OF CASES.

Because of the variety and the incomplete nature of the material, any attempt to estimate the probable ratio of fatal to total cases of anthrax is surrounded with difficulty. In the course of this study, data giving figures for both fatal and nonfatal cases were secured from a number of different sources, including a company physician, the infectious-disease reports of four States, occupational-disease reports in two States, four hospitals, and a State workmen's compensation commission. The proportion of fatal to total cases varied widely, from 3 out of 48, or 6 per cent, in the experience of the

company doctor, to 15 out of 18, or 83 per cent, in the figures reported for two years to the New York State Board of Health.

Upon closer examination, however, the discrepant figures seem to be susceptible of considerable adjustment. The ratio of fatalities experienced by the physician in question was probably extraordinarily low, due in part to his being employed directly by the tannery companies, so that he received the cases in the early stages, and in part to his considerable experience with the disease and the consequent development of a more successful treatment. The reports from the four State boards of health all covered periods of two years or less, and showed, respectively, a fatality rate of 2 cases out of 17, or 12 per cent (Massachusetts), 4 cases out of 17, or 24 per cent (Texas), 3 cases out of 5, or 60 per cent (California), or 15 cases out of 18, or 83 per cent (New York). The wide range displayed by these figures from similar sources is remarkable. Perhaps the largest single factor of error they contain is that deaths from anthrax are likely to be reported as a matter of routine with all other deaths, but that reports of nonfatal cases are more likely to be neglected. This would tend toward a preponderance of fatalities among the cases reported, a tendency the effect of which is evidenced by the fact that three of the ratios in this group are higher than the median ratio secured, and that two of them are the highest obtained from any source. Moreover, the low ratio in this group, that from Massachusetts, covers a period of only two months and four days, while there was an epidemic of the disease in that State, so that the figures are likely to be unusual.

Another group of figures, those secured through the occupational-disease reports of two States, shows a similar diversity, the New Jersey ratio for nearly four years being 1 fatal case out of 13, or 8 per cent, while the New York ratio for a slightly longer period was 13 fatal cases out of 23, or 57 per cent. Occupational-disease reports, however, are likely to suffer from the defects already mentioned as affecting infectious-disease reports, and from the further circumstance that the occupational disease reporting laws are comparatively new, are not even yet known to all physicians to whom they apply, and for business reasons are not so likely to be lived up to or enforced. The figures from the Massachusetts Workmen's Compensation Commission showed 3 fatal cases out of 30 in which claims for compensation were made in three years, or 10 per cent. Data secured from such a source should be fairly complete; but, since the ratio is the third lowest in the series, it is probably best not to attach too much importance to it.

The figures which from the standpoint of accuracy of diagnosis and completeness of recording are probably most valuable for the

purpose in hand are those from hospitals. Returns from four of these institutions for widely varying periods were secured, and it is interesting to note that the ratios they present group closely together near the middle of the range of ratios studied. Thus two Massachusetts hospitals had, respectively, fatality rates of 6 out of 35, or 17 per cent, and 2 out of 4, or 50 per cent. A Philadelphia hospital had 6 fatal cases out of 32, or 19 per cent, while a New Orleans institution had 1 out of 5, or 20 per cent. The first, third, and fourth of these ratios are in substantial agreement; the variation shown by the second set of figures is possibly due to their coming from a small hospital in the same city as the much larger institution from which the larger number of cases was reported. If the three sets of hospital figures which are in closest agreement, and which incidentally include the largest numbers of hospital cases reported, are taken as a reasonable gauge, the probable proportion of fatal to total cases would seem to be about 1 out of 5; or 20 per cent.¹

LEGISLATION.

American legislation regarding anthrax deals (1) with the reporting of cases, (2) with measures for prevention, and (3) with compensation or insurance for those who contract the malady in the course of employment. In none of these fields is the legislation as thoroughgoing, as widespread, or as vigorously enforced as the situation demands, but the beginnings have been made and further study of the subject should result in its extension and substantial improvement.

REPORTING.

In the United States, as in most civilized countries, the value of reporting or notifying infectious diseases is generally recognized. Mortality statistics compiled from the official certificates of death indicate roughly the geographical distribution of a disease and its trend toward higher or lower frequency. As has been seen, however, the mortality statistics of anthrax cover but about one-fifth of the total number of cases, and therefore fail to give any adequate information on its actual extent, occupational causation, and numerous other features of social interest. Still more important, only by reporting infectious diseases as soon as diagnosed can epidemics be recognized, checked, or prevented.

Reporting of human anthrax is, nevertheless, a comparatively recent advance in this country, being required, even as late as July,

¹ This figure is in substantial accord with that of the British authorities, Bell and Legge, who state that "In Europe about 25 per cent of all cases prove fatal." (Allbutt and Rolleston: *System of Medicine*, 1906, p. 252.)

1911, in only seven States. But because of the growing frequency of anthrax, together with more lively interest in occupational as well as infectious diseases, reporting laws spread rapidly, and by January, 1916, anthrax had been made notifiable in the following 24 States and in Porto Rico:

Alabama, California, Connecticut, Delaware, Florida, Illinois, Kansas, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, South Dakota, Texas, Vermont, and Washington.

In most of these anthrax is on the list of notifiable infectious diseases, and reports must be sent to the local board of health or health officer, by whom they are transmitted to the State board of health. The obligation to report usually rests upon the physician, and in some States, if there is no physician in attendance, any other person knowing of the case is required to report it. Some States provide for the payment of a small fee to the physician or other person making the report. In New York, for instance, the fee is 25 cents in cities and 20 cents in villages and towns. In Michigan and New Jersey, 10 cents is paid, whereas in some States, such as Connecticut and California, the person reporting is entitled to 50 cents. Failure to report is usually punished by a fine, varying from \$5 in Maryland to \$50 in New Jersey. In some States the provisions for enforcement are more stringent. Thus in Washington the State board of health may remove from office any health officer who refuses or neglects to make prompt and accurate reports.¹

In addition to requirements for notification of infectious diseases, 12 of these States² have adopted statutes or administrative orders requiring physicians to report, as an occupational disease, every case of anthrax "contracted as the result of the nature of the patient's employment." The standard certificates used under these statutes are usually made returnable to the State board of health, which often must transmit them to the State department of labor; sometimes, however, the reports go directly to the labor department. The blanks are more detailed than the ordinary infectious-disease blank, asking, in addition to the name and address and nature of the illness of the employee, his occupation, length of time therein, and the

¹ According to the weekly United States Public Health Reports there were reported between the first of the year and Nov. 1, 1916, under the infectious disease reporting laws, 48 cases of anthrax, distributed as follows: California 7, Louisiana 6, Massachusetts 25, Michigan 1, New Jersey 3, New York 5, Ohio 1. For special discussion of anthrax reports received under the infectious disease reporting laws of Pennsylvania and Massachusetts, see pp. 31, 38, and 79.

² California, Connecticut, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Ohio, and Rhode Island.

employer's name, address, and business. A careful study of occupational hazards is thus facilitated. Two of these 12 States (California and Connecticut) offer a 50-cent fee as an inducement toward more thorough reporting; penalties for failure to report range from \$5 to \$50, while Minnesota provides as alternative to a \$10 fine, imprisonment for not more than 10 days.¹

PREVENTION.

The story told by such statistics of anthrax as the present mortality registration and disease-reporting laws have made available is one of steadily and, of late, even sharply increasing prevalence. The cause of this condition must be sought in the incomplete and lax character of existing efforts at prevention, both in agriculture and in trade and manufacture, especially in the latter.

Agriculture.

Since anthrax in man is practically always the result of contagion in some manner from animals, one essential in eradicating the disease is to prevent it among animals. Laws and regulations for the suppression of animal anthrax have been enacted in all civilized countries and in all the large stock-raising sections of the United States.

Congressional action covering this matter dates from 1865, when an act was passed prohibiting the importation of cattle from any foreign country into the United States.² The Secretary of the Treasury was, however, given power to suspend the prohibition whenever he determined that such importation would "not tend to the introduction or spread of contagious or infectious diseases among the cattle of the United States." Except for an extension to be mentioned later, this provision has been embodied practically unchanged in successive tariff laws, and to-day forms subsection 1 of Section IV-H of the tariff act of October 3, 1913. Under its terms importations of neat cattle were permitted in the summer of 1916 only from Great Britain, Ireland, the Channel Islands, New Zealand, and North America. In 1884, with the organization of the Bureau of Animal Industry in the Department of Agriculture, the formulation of rules governing importations of live stock was taken over by that department.

¹ For summaries of cases reported under the New York and the New Jersey occupational disease reporting statutes, see pp. 35 and 37. In New Hampshire 2 cases were reported under this law in 1915. Both patients were laborers in a tannery, and both recovered. In Maryland the remarkable case was reported in 1914 of a 15-year-old boy who contracted the disease while working as a doffer in a woolen mill.

² United States, Statutes at Large, Vol. XIV, p. 1.

In most States, also, the regulations do not refer specially to anthrax, but apply to infectious cattle diseases in general. Almost all of these States forbid the importation of animals affected with contagious or infectious diseases. Cases of such diseases must be reported, and an official of the veterinary department is required to investigate, to examine the stock, and to prescribe necessary measures for the protection of healthy stock. Diseased animals or those which have been exposed to the disease must be quarantined. To prevent further spread of the disease many States prescribe the killing of affected or exposed animals; frequently in such cases an official or a committee appraises the animals and the owner is compensated for the loss. Complete and careful destruction of carcasses of animals dying of the disease and disinfection of their stalls are also required. Failure to comply with the regulations is punishable by a fine ranging, for ordinary offenses, from \$5 to \$500. Penalties as high as \$5,000 may be levied in Tennessee for importing diseased stock, and in Virginia for failure to disinfect freight cars.

Several States, however, chiefly in the West and South, where stock raising is an important industry and where anthrax is prevalent, have prescribed measures specifically for the prevention and eradication of this scourge. These measures are on the whole similar to the general regulations just described. Periodic vaccination of herds, which is compulsory in a number of countries abroad and which has proved its effectiveness as a preventive measure, is strongly advocated by agricultural stations in this country but is required in only a few States. In Kentucky, vaccination is prescribed for all animals which have been exposed to the disease. The vaccine must be approved by the United States Bureau of Animal Industry, by the Kentucky Agricultural Experiment Station, or by the State live stock sanitary board. In Pennsylvania the State live stock sanitary board, according to one of its officials, prepares and distributes to qualified veterinarians, free of cost, anthrax vaccine for use on exposed animals. Early each spring, for years, it is reported, the board has vaccinated the stock on all premises where anthrax is known recently to have existed. Formerly the vaccine was furnished free of cost and the work carried on at the expense of the State. Since 1916, however, the State merely supplies the vaccine and does not pay for its administration. Similar precautions are being taken in other States.¹

¹ During June and July of 1916 serious anthrax outbreaks occurred among cattle in the neighborhood of Buffalo, N. Y., in Arkansas and Texas and in the Mississippi Delta region of Louisiana. Prompt work by State veterinary officers in killing infected cattle, securing their burning or deep burial in quicklime, vaccinating exposed herds, and establishing quarantines, succeeded in checking the plague. Several human cases were reported in this connection, including the death of the State veterinarian of Texas.

Trade and Manufacture.

The question of prevention of anthrax among industrial workers, which is the subject of extensive legislation in the leading countries of Europe, has so far received little attention in the United States. Not a single special factory or workshop regulation for the safeguarding of employees against this disease has yet been enacted by any State. What governmental precautions do exist refer only to the importation of dangerous animal materials and until January 1, 1917, these were limited in application to hides and glue stock from "neat cattle." The dangers lurking in imported hair, wool, and bristles, in horsehides, and in goat and sheep skins were completely ignored.^a

Imports for the six years ending June 30, 1915, of animal materials liable to carry anthrax are shown in the following table, in which the figures represent thousands of pounds:

TABLE 7.—IMPORTS OF ANIMAL PRODUCTS LIABLE TO BE INFECTED WITH ANTHRAX, 1910 TO 1915.

[Compiled from reports of United States Bureau of Foreign and Domestic Commerce on imports of merchandise into the United States. Figures represent thousands of pounds.]

Materials and the country from which exported.	Year ending June 30—					
	1910	1911	1912	1913	1914	1915
HIDES AND SKINS, RAW OR UNCURED.						
Dry:						
Total.....	¹ 608,615	177,746	234,914	257,373	231,183	209,119
South America.....	¹ 152,802	51,639	76,324	55,972	54,107	71,085
Asia.....	¹ 89,235	45,433	45,515	72,177	60,873	64,881
Africa.....	¹ 7,490	6,593	6,317	6,432	5,676	13,777
Green or pickled:						
Total.....	(2)	197,140	302,849	314,817	329,880	329,095
South America.....	(2)	27,295	57,656	52,504	71,809	135,191
Asia.....	(2)	22,345	26,331	26,995	23,440	18,835
Africa.....	(2)		22	399	1,209	420
WOOL, HAIR OF THE CAMEL, GOAT, ALPACA, AND OTHER LIKE ANIMALS, MANUFACTURED.						
Total.....	263,927	137,646	193,399	195,292	247,645	308,081
South America.....	37,341	21,021	30,626	29,188	47,504	95,734
Asia.....	59,921	38,987	50,679	55,415	44,343	40,959
Africa.....	145	121	342	387	711	25,068
HORSE AND OTHER ANIMAL HAIR MANUFACTURED.						
Total.....	18,759	7,534	16,176	16,495	14,245	11,689
South America.....	2,941	2,426	2,625	2,313	1,573	1,872
Asia.....	130	75	343	451	200	416
BRISTLES.						
Total.....	4,029	3,553	3,461	3,578	3,436	4,061
Asia.....	1,722	1,491	1,565	1,483	1,592	2,482

¹ Including dry, green, and picked hides and skins.

² Included in dry hides and skins.

^a Certain regulations did exist regarding the disinfection of wool, horse, and other hair imported from South America, but these had reference only to foot-and-mouth disease. (Treasury decisions 30783, July 13, 1910, and 32027, Nov. 23, 1911.) It is said that in one State the board of health requires hair shipped into the State to be submitted to a temperature of 200° F., but this report could not be verified.

Precautions for obviating the danger of anthrax from imported animal materials were first taken by Congress in 1866. In that year the same Congress which had limited the importation of cattle as already described amended the law to apply as well to the "hides of neat cattle."¹ Incorporated in the original statute which it extended, this amendment also has come down to the present time as part of the tariff law. While the Department of Agriculture, as stated, has taken over the regulation of live-stock importations, the Treasury Department still has charge of the regulation of hide imports, the actual administration of both sets of rules, however, being performed by the Quarantine Division of the Bureau of Animal Industry.

The tariff clause under discussion, however, provides only for the unregulated entry or the absolute exclusion of hides from suspected areas, and is therefore likely in application to be either too lax or too strict. More precise safeguards against anthrax were needed, and are now authorized by section 2 of the act of February 2, 1903.² This section empowers the Secretary of Agriculture to take measures against the introduction of contagious diseases of animals from a foreign country into the United States or from one State of the United States into another. In pursuance of this act the Secretary of Agriculture has at various times made recommendations for the disinfection of imported hides, with special care against anthrax, and rules embodying these recommendations have been issued by the Division of Customs of the Treasury Department.

The rules in force during 1916 were based on an order which went into effect June 1, 1910.³ It required that untanned hides of neat cattle (later interpreted to include buffalo⁴), hide cuttings or parings, and glue stock, shipped from districts where anthrax was known to the American consul to be prevalent, undergo disinfection by immersion for at least 30 minutes in a 1 to 1,000 solution of bichloride of mercury. Consuls in such districts were instructed to refuse the certification of invoices covering the above products for shipment to this country unless they were disinfected by the prescribed method, and admission was refused to products requiring disinfection which lacked the proper certificate. Disinfection of suspected products on the dock upon arrival in this country or their transportation across American territory was not permitted, as it might tend to propagate the disease in this country. Disinfection was also required for hides produced in North America if landed and transshipped in another country in the course of importation. The rules did not

¹ United States, Statutes at Large, Vol. XIV, p. 3.

² United States, 32 Stat., 791.

³ Treasury decision 30583, May 2, 1910. Also known as Treasury Department Circular No. 23 (Division of Customs).

⁴ Treasury decision 31981, Nov. 2, 1911.

apply, however, to goatskins, sheepskins, or articles manufactured from the hides of neat cattle.

The delay and expense necessitated by even these mild regulations caused considerable opposition among American importers, which may have been increased by the cutting off, through the war, of hide importations from Europe, especially from Russia, and the consequent augmentation of imports from more dangerous sources, such as China. Moreover, tests seemed to show that soaking in bichloride of mercury solution of the prescribed strength for so brief a period as half an hour was totally insufficient to exterminate anthrax spores.¹

Accordingly, late in 1915, the regulations were modified² to permit the substitution of either of two methods of disinfection which experiment had indicated were more efficacious. One of these was immersion for not less than 48 hours in a solution containing 10 per cent of sodium chloride (common salt) and 2 per cent of hydrochloric acid in water; the other was immersion for not less than 24 hours in a solution containing 2,500 parts of a 1 per cent formic acid solution and 1 part of mercuric chloride.³ The Secretary of Agriculture, according to the order, stated that "these methods of disinfection for anthrax hides or anthrax suspected hides will be acceptable to his department."

In a little over four months, however, another amendment to the regulations was issued which, as far as anthrax is concerned, almost completely frustrated their purpose. This remarkable amendment⁴ provided that "in future when a shipment of hides which requires * * * a certificate of disinfection arrives without such certificate" the importer might apply for permission to perform the disinfection at his tannery. If the importer had "proper facilities" the Department of Agriculture was to permit the disinfection under supervision of an inspector from the Bureau of Animal Industry, and the customs collector, upon being so advised, "shall permit the hides to go forward from the port of entry to the tannery under customs seals," notification of his action being sent to the inspector who is to supervise the disinfection.

It has been seen, however, that in almost every group of cases studied most of the tannery workers contracting anthrax did so in the early processes of trucking the hides to the tannery, receiving, checking, sorting, and storing them. Another striking revelation is the large proportion of cases among longshoremen, teamsters, and other baggage handlers, including even a Government weigher at-

¹ See p. 118.

² Treasury decision 35761, Oct. 11, 1915.

³ The same as bichloride of mercury.

⁴ Treasury decision 36188, Feb. 25, 1916.

tached to the customhouse.¹ In view of these facts, it would seem that permitting suspected materials to arrive in America and to spread contagion in their wake from dock to railroad, from railroad to dray, and from dray to warehouse and tannery before they were finally disinfected was a violation of elemental principles of caution and sanitation.

Nevertheless, the Agriculture and the Treasury Departments continued to weaken their requirements. Under date of April 20, 1916, still another modification² was promulgated, setting forth that thereafter even "foreign hides which can not be certified by an American consul as coming from a district in which * * * anthrax is not prevalent" were to be allowed the right of shipment. The only restriction was that the bales must "have been whitewashed under consular supervision," and that they were "subject to disinfection after arrival at destination in this country." The provisions for supervising the disinfection at destination remained the same as before, but the process was made more thorough, immersion in a 1 to 1,000 solution of bichloride of mercury for at least 48 hours being now required. While this rule extended a measure of protection to tannery workers in the later processes which even the original requirement of disinfection for 30 minutes did not afford, it still left transportation workers and those engaged in receiving the hides at the tanneries exposed to the full hazard of the disease. However, even the prescribed method of disinfection was not always sufficient to destroy the anthrax spore. Moreover, there were serious difficulties in the way of enforcement, since the consuls, who were to require the whitewashing of hides coming from anthrax-infected districts, did not always possess sufficient information as to the location of the outbreaks. This source of danger was pointed out as early as 1897. "Some of these officers (consuls) have frankly stated that the regulations for the disinfection of hides were not and could not be enforced by them."³

Under these circumstances the increasing number of anthrax cases continued to force attention, and in the fall of 1916 a special committee of the National Association of Tanners cooperated with the Federal authorities in the preparation of more effective provisions for the disinfection of imported hides.⁴ Under the new regulations the importation of hides, wool, glue stock, or other products from animals affected with anthrax is prohibited. For hides from anthrax-infested districts the 30 minutes' immersion in 1 to 1,000

¹ See fatal case No. 111, p. 75.

² Treasury decision 36332, Apr. 20, 1916.

³ Delaware College Agricultural Experiment Station: Anthrax. A Study of National and of State Legislation on This Subject, Bul. No. XXXVII, 1898.

⁴ Now issued as United States Treasury Department and Department of Agriculture Joint Order No. 1, effective Jan. 1, 1917. (See Appendix A.)

bichloride of mercury solution allowed at the port of shipment is extended to 24 hours' immersion. Materials shipped without disinfection and without a consular certificate showing nonprevalence of anthrax may still be received in this country and transported, under customs seals, to the tannery, where they are to be disinfected under supervision of an agent of the Bureau of Animal Industry at the tannery's expense. The previous method of disinfection at the tannery, namely, soaking for not less than 48 hours in a 1 to 1,000 bichloride of mercury solution, is still accepted, but as a substitute hides may be immersed for not less than six days in a 1 to 5,000 bichloride of mercury solution, followed by not less than 5 days in lime of the usual strength for dehairing, which is believed by the bureau effectively to disinfect hides against anthrax.¹ The new regulations also contain for the first time detailed requirements for the disinfection of glue stock, bones, hoofs, wool, and hair, and of cars, boats, other vehicles, and certain premises.²

The growing frequency of anthrax among industrial workers in New York and Massachusetts during 1915 and the early part of 1916 stimulated interest in the question among officials of these States. In New York the industrial commission investigated the reported cases which developed during the last 10 months of 1915, and called a conference on the subject for March 27, 1916. Four State departments were represented—the conservation commission, the department of agriculture, the department of health, and the industrial commission. The conservation commission reported that in response to a petition from the residents of one county, who complained of a leather factory as the polluting agent, it was studying the relation of stream pollution to anthrax. Appointment of a committee of one representative from each department was suggested for the purpose of studying the question thoroughly. Recommendations later issued by the division of industrial hygiene of the industrial commission are reprinted in Appendix A.

In Massachusetts the occurrence, early in 1916, of 25 cases, at least four of which were fatal, and which centered among the tannery workers at Woburn and Winchester, started an investigation by the State department of health, with the cooperation of the board of labor and industries. Investigators were sent to near-by States to trace the suspected shipments of hides to their source and to learn whether cases had been caused by them elsewhere. It was found that 20 of the cases were infected from one source, a cargo of dried hides from China.³ Rules subsequently suggested by the State board of labor and industries for the handling of hides, skins, and wool are reprinted in Appendix A.

¹ See p. 120.

² See Appendix A.

³ United States Public Health Reports, Dec. 15, 1916, pp. 3399-3402.

COMPENSATION.

Also, in the matter of workmen's compensation for victims of occupational anthrax the United States has made but little progress—much less than other leading countries. While Great Britain, Germany, France, Holland, Italy, South Australia, and the Canadian Province of Ontario have for years been awarding such compensation, in the United States only one State is as yet acting consistently on this principle.

The Massachusetts workmen's compensation law, when it was drafted, was made to cover "personal injury," instead of merely "personal injury by accident" as did most of the other State laws. Occupational diseases were thus included, and during the first three years of the operation of the act, closing June 30, 1915, there were filed with the industrial accident board 30 claims for compensation on account of occupational anthrax, in 17 of which awards were made.

TABLE 8.—CLAIMS FOR COMPENSATION ON ACCOUNT OF ANTHRAX FILED UNDER THE MASSACHUSETTS WORKMEN'S COMPENSATION LAW, 3 YEARS ENDING JUNE 30, 1915.

Occupation.	Duration of disability.	Compensation.	
		Indemnity for wage loss.	Medical aid.
HIDE AND SKIN WORKERS.			
Lumper in beam house.....	No disability....	None due.....	Not reported.
Beamster.....	1 week.....	do.....	Do.
Machine operator in beam house.....	1½ weeks.....	do.....	Do.
Lumper.....	1½ weeks.....	do.....	Do.
Lumper in dry loft.....	2½ weeks.....	\$2.86.....	Do.
Lumper in storehouse.....	2½ weeks.....	\$2.57.....	Do.
Lumper in beam house.....	2½ weeks.....	\$5.43.....	Do.
Tanner.....	3 weeks.....	Not reported.....	Do.
Do.....	3½ weeks.....	do.....	Do.
Do.....	4 weeks.....	do.....	Do.
Leather finisher doing "seasoning".....	5½ weeks.....	\$14.28.....	\$5.00.
Foreman in rough stock department.....	6 weeks.....	\$18.00.....	Not reported.
Laborer in leather factory.....	do.....	\$16.00.....	Do.
Tanner.....	6½ weeks.....	Not reported.....	Do.
Lumper.....	7 weeks.....	\$21.43.....	Do.
Splitter of skins in leather factory.....	7½ weeks.....	\$23.79.....	Do.
Lumper in coloring room of a calf-skin tannery.....	Fatal.....	Unable to locate dependents in Europe.....	Do.
Worker in soaks in beam house.....	do.....	do.....	Do.
TRANSPORTATION WORKERS.			
Longshoreman.....	1 week.....	None due.....	Do.
Do.....	3½ weeks.....	\$11.42.....	Do.
Do.....	5½ weeks.....	\$23.22.....	\$16.00.
Do.....	6 weeks.....	\$24.00.....	Not reported.
Do.....	8½ weeks.....	\$58.04.....	Do.
Do.....	Fatal.....	(1).....	(1)
Laborer for private weigher.....	7½ weeks.....	\$34.46.....	Not reported.
Do.....	15 weeks.....	\$78.00.....	\$56.00.
Do.....	15½ weeks.....	\$110.86.....	\$1.00.
WOOL AND HAIR WORKERS.			
Foreman wool-pulling department.....	2 weeks.....	None due.....	\$9.50.
Picker hand in felt factory.....	11½ weeks.....	\$83.84.....	Not reported.
Brush drawer in brush factory.....	Over 2 years; exact time not reported.....	\$754.69.....	\$18.29.

¹ Compensation refused.

Hide and skin workers made up over one-half of the claimants, or 18 out of the 30. Of these, seven were "lumpers" in leather factories, six of whom were employed in one establishment in Salem. One was a foreman in the "rough stock" department in a goat and sheepskin tannery; one was splitting skins in a leather factory; one was a leather finisher engaged in "seasoning"—he applied finish to skins with a sponge, and an "eruption on both his hands and forearms" is reported. One tannery employee worked in "soaks in beam house"; there were also a "machine operator in beam house," a "beamster," and a laborer, all employed in leather factories. In four cases it was merely stated the "men worked in tanneries."

Transportation workers were represented by nine claimants. Six of these were longshoremen, of whom five were employed by one concern in Boston. One was, by his own testimony, on or about July 24, "discharging buffalo hides from a steamship. I had been on this job four days when I got a scratch on my arm. The following day I noticed something like a wart which was itchy. I finished the job and there was no work until August 5. I started to go to work on this day, but my arm was itchy and sore, and I went to the hospital instead, where they said I had anthrax, and was operated on right away." Another of the longshoremen "had been pushing behind truck unloading hides for three days, and he stopped work at the end of the third day, as his hands began to swell"; two were "handling salt hides," and one "green" hides, at the time they contracted anthrax; the sixth was unloading wool and hides, in addition to other cargo. The remaining three transportation workers were reported as "laborers," all employed by a firm of weighers in Boston.

Two cases occurred among woolworkers; one was a foreman in the wool-pulling department of an establishment where wool was pulled and scoured; the other was a "picker hand" in a felt factory. The report reads: "Sliver ran into his leg. It was removed and leg was poisoned from wool. Anthrax and complications on left lower extremity."

One applicant for compensation was a brush drawer. She scratched her face over the left eye, and as a result anthrax developed.

The periods of disability ranged from one week to over two years. In one case no disability resulted and the employee remained at work; five workers were disabled from one to two weeks. In none of these six cases was compensation awarded, as the law requires a waiting period of two weeks. Medical aid is allowed by the Massachusetts law from the day of disability, but in only one of these six cases was it stated that such aid was given. In the remaining cases disability lasted beyond two weeks, and 17 awards for compensation, beginning with the third week and equal to two-thirds of average weekly wages, were made. The amounts ranged from \$2.57 for a

disability of two and two-sevenths weeks to \$754.69 for a disability of over two years. This case was finally disposed of by a lump-sum payment toward the close of the second year of weekly payments. In addition to the weekly indemnity for loss of wages, medical attendance costing from \$1 to \$56 was paid for in at least six cases.

Three of the claims were filed in behalf of workers whose anthrax attacks ended fatally, the course of the disease being extremely rapid in all three instances. Two of the victims were taken to a hospital two days after they began to feel ill; one died in five hours and the other in 17 hours after admission. In neither of these cases was compensation paid, as it was impossible to locate the dependents in Europe. In the third fatal case, in which death occurred three days after admission to the hospital, the claim for compensation filed by the victim's mother was disallowed by the arbitration committee to which it was referred. While there was no question as to the cause of death, the insurer contended that the disease was not contracted while the deceased was in the employ of their policyholder, but while working for another company, which was not insured under the act.

One-third (10) of the cases considered in this section occurred in Boston. Six were from Salem; Haverhill, Peabody, and Lynn furnished each two cases; Worcester, Davenport, Millbury, and Woburn, one case each; in the remaining four cases the place of employment could not be ascertained. Only one of those injured was a woman. The youngest was 17 years old; one-half, or 15, were between the ages of 20 and 29, eight were between 30 and 39, five between 40 and 49, and one was 60 years of age.

Most frequently, or in nine cases, the lesions were on the face. In seven they were on the hand or arm; five workers, of whom one died, had the pustule on the neck; one, who died, had it on the chest, and one on the leg. In the seven other cases the location of the lesion was not stated; one of these, however, ended fatally and, judging by the symptoms, it was probably a case of internal anthrax. The cause of death was given as "lobar pneumonia," and for this reason the case was not listed among those reported in the United States registration area. Nevertheless, a blood smear sent to Harvard Medical School showed the presence of anthrax bacilli.

Another State which has taken the same enlightened position as Massachusetts is California. The compensation statute of this western Commonwealth applied, as enacted, only to "personal injury sustained . . . by accident." By amendment in 1915 the words "by accident" were stricken out, so that the law is now as broad in scope as that of Massachusetts. Up to May 1, 1916, however, no claim for anthrax had been presented to the industrial accident commission, so that the first California award for this trade illness had still to be made. In 1915, also, Pennsylvania amended its

constitution to allow the passage of a law establishing compensation for occupational diseases, and the legislature of 1917 will have an opportunity to enact the necessary legislation.

The compensation laws of the remaining States do not cover diseases of occupation. Nevertheless in a certain number of cases indemnity for anthrax has been allowed when infection developed as a result of an accidental injury sustained by the worker in the course of employment.

In New York, for instance, five such claims were filed during the first 22 months of the operation of the act (July 1, 1914, to May 1, 1916). In three cases agreements were arrived at between the injured workmen and the insurance carriers, and compensation for periods ranging from two to six and two-sixths weeks had already been paid at the time of this writing. In another case, in which death occurred, it was recommended that the claim be disallowed as the scratch through which infection occurred was received while the man was being shaved, and was not due to an accident in the course of employment.¹ On the remaining claim, which was the first to be presented in New York, the commission awarded seven and five-sixths weeks' compensation. The insurance company took an appeal, but later withdrew it and paid the claim. The workman concerned, an employee in a plant where raw skins are handled, was trimming sheepskins on the day of the accident. He hit his jaw against the beam on which he was placing skins for the purpose of cutting off the head, tail, and legs. The accident occurred in the forenoon and caused an abrasion of the skin, with pain and smarting, so that during the afternoon the claimant frequently rubbed the sore place with his hand. On the next day a doctor was called in, found a pustule at the seat of the injury, and diagnosed the case as anthrax. The commission decided that the injury "was an accidental injury, and arose out of and in the course of his employment." The insurance carrier appealed on the ground that anthrax is an occupational disease in tanning, and that therefore the compensation act does not require damages, but the court sustained the commission, thus establishing a favorable precedent for New York State.²

The situation in New Jersey is the same as that in New York. Records of the employers' liability commission in that State for the year 1915 reveal four cases in which "there was previously a specific accident which later became infected (anthrax)." In three cases the employees were working on hides and skins; the occupation of the fourth worker is not given; it is merely stated that he was injured on a shearing machine. One was a fatal case; the other em-

¹ For authentic cases of infection through shaving brushes, see p. 23.

² The appeal was argued in the Appellate Division of the Supreme Court, at Albany, during the May, 1916, term.

ployees were out for three, five and two-sixths, and eight weeks, respectively. The amounts awarded in the fatal case, where there were no dependents, were \$100 for burial and \$13 for medical aid. In the other cases compensation at half the average wages amounted to \$29.17, \$16.67, and \$36, respectively, and for medical aid \$33, \$41.50, and \$44 was allowed.

In Pennsylvania the workmen's compensation law of 1916, similar in intent to the laws of New York and New Jersey, provides that "the terms 'injury' and 'personal injury' as used in this act shall be construed to mean only violence to the physical structure of the body, and such disease or infection as naturally results therefrom." When in April, 1916, a claim was filed with the workmen's compensation board on the part of a hair sorter¹ who had contracted anthrax, the claim was disallowed, as the examination of the physician "disclosed no evidence of any wound or cut upon the person of the claimant nor did the investigation, made at this time, discover any unusual incident or occurrence that had happened to the employee in the course of his employment. The claimant also admitted that there had been no wound or other unusual incident."

As far as can be learned no other State has yet been called upon to decide a compensation claim arising from anthrax, but probably the outcome would be the same as in New York and New Jersey. While this would permit indemnity for a limited number of cases—those resulting from a definite physical wound—such a policy is far from just. In equity to sufferers from the disease, no less than from the standpoint of enlisting the full interest of employers in methods of preventing infection, all cases of occupational anthrax should be compensated upon the same terms as industrial accidents.

¹ Working in a tannery.

CHAPTER V.

ANTHRAX IN EUROPE.

In Europe, where occupational anthrax has been a matter of public moment for a much longer period than in the United States, the campaign against it has been pressed with a consistency and vigor not yet displayed in this country. Among legislators and administrative officials, no less than among employers and physicians, there has been keen realization of the dangers of the scourge and of the urgency of measures for its eradication.

PRIVATE ACTIVITY.

The dramatic acuteness and high mortality of anthrax have led abroad to considerable private activity for its study, cure, and prevention. In England, Germany, France, and Italy influential associations of manufacturers have interested themselves in the problem, while scientific societies of international scope have cooperated in the campaign.

ANTHRAX INVESTIGATION BOARD FOR BRADFORD AND DISTRICT.

Since in England the manipulation of dangerous kinds of wool is practically confined to the West Riding of Yorkshire, the chamber of commerce of that district, at a joint meeting with representatives of labor unions, organized in 1905 the now famous Anthrax Investigation Board for Bradford and District. The purposes of this organization are (1) the investigation of anthrax generally; (2) the more precise determination of the classes of wool and hair in connection with which the danger of anthrax arises; and (3) the discovery of further means of prevention. The investigation is carried on through inquiries into cases of anthrax, and samples are collected of the material causing the infection. The data thus obtained are brought to the knowledge of the manufacturers. The board has engaged the services of a bacteriologist, some of whose duties are (1) the examination of material which has caused outbreaks of anthrax; (2) systematic examination of samples irrespective of any such outbreaks; (3) studying of the part played in infection by the sand, dirt, and organisms present in the material; (4) verification of doubtful cases and examination of material submitted by physicians. Particularly careful study is given to the urgent question of disinfecting raw wool, and especially to the removal of blood clots and bloodstained fibers, which are frequent carriers of spores.

In order to secure effective results a large and representative membership was considered necessary. The board is therefore composed, in addition to the bacteriologist, the honorary consulting chemist, and the secretary, of 18 members, elected annually from among the manufacturers, the members of the Bradford Chamber of Commerce, and the health committee of the Bradford City Council; occasionally representatives of organized labor are included. The activity of the board is made possible chiefly by private contributions, the majority of contributors being employers, although labor organizations and occasionally private individuals also subscribe. A point deserving special mention is the annual subvention of \$250 granted for several years by the Home Office, which in 1913 was raised to \$500.

To obtain the highest possible degree of efficiency the board is constantly seeking the cooperation of the medical profession. Circulars are distributed inviting physicians to send in information of each case of suspected anthrax, together with serum or blood for examination. The board emphasizes the necessity of speedy action in suspected cases and urges particular care with regard to bloodstained materials. Its statistics, which will be discussed later, are excellent, and the educational propaganda which it carries on is undoubtedly an important factor in the antianthrax campaign.

GERMAN EMPLOYERS' MUTUAL TRADE ASSOCIATIONS.

The activity of the German manufacturers has taken an entirely different form. In Germany preventive measures are introduced by the employers' mutual trade associations (*Berufsgenossenschaften*) in those trades where the danger of anthrax is present. These associations are organized primarily for the purpose of carrying mutual workmen's compensation insurance. Since it is to their financial advantage to have as few industrial accidents as possible, the activity of these associations is remarkably effective, aiming at the prevention of both industrial accidents and diseases. The employers of practically all industries have combined into such associations and, as anthrax is compensated as an industrial injury, the associations for the leather, wool, hair, and brush industries have set forth carefully worked out rules based on the latest achievements of technical and sanitary science. These rules when officially indorsed have the force of law. A considerable incentive to the observance of these rules is provided in the cleverly arranged sliding scale of premiums required from the employer and based on the number and effectiveness of safeguards introduced in his factory; that is, the more attention is paid to disease and accident prevention, the lower are the insurance premiums charged the owner of the establishment.

The employers conduct the accident insurance activity of the trade associations, but in order to elicit the fullest cooperation of the workers they have given the latter a voice in framing the safety and sanitation rules; they have gone even further and have made the workers responsible for compliance with those rules which concern them. The value of personal appeal has also been appreciated by these associations; they have addressed warnings to the workers instructing them in the dangers and urging precaution. The remarkable thoroughness with which these employers' mutual associations have carried out their tasks has placed them in the foreground as powerful factors in the promotion of industrial health and safety.

ASSOCIATION OF FRENCH MANUFACTURERS FOR THE PREVENTION OF INDUSTRIAL ACCIDENTS.

The idea of employers' mutual organization for the purpose of accident prevention has found application in other countries also. In France in 1883 the manufacturers combined into the "Association des industriels de France contre les accidents du travail," which by a Government order was recognized in 1891 as a public service organization (*Établissement d'utilité publique*).¹ This association publishes instructions to workers similar to those issued by the Home Office in England and by the German trade associations, and requires that they be posted in work places where the danger of anthrax is present.

MILAN LABOR CLINIC AND OTHER PRIVATE ACTIVITY IN ITALY.

In 1910 the celebrated Labor Clinic at Milan, the first of its kind in the world, was established by a group of socially minded medical men "for the scientific study and prevention of occupational diseases." In cooperation with the Permanent International Commission for the Study of Occupational Diseases, which has its headquarters in the same city, the clinic has issued sanitary regulations and is carrying on an educational propaganda among workers and employers in the industries which involve exposure to anthrax. There exists in Italy also the Industrial Employers' Association for the Prevention of Industrial Accidents (*Associazione degli Industriali per prevenire gli Infortuni del Lavoro*), an organization very similar to the French association which has already been described. This body issues instructions for workers, and also publishes occasional studies on occupational anthrax.

A notable instance of self-imposed but rigidly observed regulations is found in the hair works of Carlo Pachetti & Co., at Pavia. This is the largest establishment of its kind in Italy, and it receives practically all the hair imported. The firm is equipped with

¹ Walter Abelsdorff: *Gewerbliche Milzbrandvergiftungen in Deutschland, Frankreich, England, und Holland*, 1915, p. 7.

all the requisites of modern industrial hygiene, and has adopted the most advanced measures for the prevention of anthrax. Each process is carefully regulated. The hair is disinfected; great care is given to ventilation, cleanliness, and the elimination of dust; and medical supervision of the highest order is instituted, even a bacteriological laboratory being provided and a supply of the Sclavo serum being kept. The proprietor states that cases of anthrax are detected in the earlier stages and promptly treated, and that the patients usually recover "without cessation of work for more than a day or two."¹

INTERNATIONAL ORGANIZATIONS AND CONGRESSES.

Anthrax has also been carefully studied outside of industry. Besides the Permanent International Commission for the Study of Occupational Diseases, already mentioned, both international congresses on occupational diseases which have so far taken place, one at Milan in 1906 and the other at Brussels in 1910, have discussed the subject. More prominence was given to it on the program of the proposed third congress on occupational diseases, which was scheduled for Vienna in 1914 but was postponed on account of the war. In that congress, papers were to be read by such authorities as Dr. Legge of England, Cavallé of France, and Dr. Holtzmann of Germany. Keen interest is also taken in the subject by the International Association for Labor Legislation, of which the American Association for Labor Legislation is an active branch. At the seventh delegates' meeting of the international body, which took place in Zürich September 10 to 12, 1912, a subcommittee was appointed for the study of occupational anthrax, the recommendations of which will be found in the concluding part of this report. The subject was also on the program of the eighth delegates' meeting, which was expected to meet in Bern September 14 to 17, 1914.

GOVERNMENTAL INVESTIGATIONS.

Probably the first official investigation of anthrax was made in 1842 in France. In that country severe epidemics of the disease among animals in certain districts and its consequent frequency among human beings had led to these areas being called "champs maudits," or cursed fields. The investigation was undertaken at a time when medical science was rather primitive, and antedated by eight years the discovery of the bacterium. Hence it did not bring forth any considerable results, but the interest of the Government is significant. In later years the question of anthrax was taken up by a commission on industrial hygiene organized under the Ministry of Labor.

¹ See C. H. W. Page: British Industrial Anthrax, in *Journal of Hygiene*, December, 1909, p. 373.

In England the initiative against anthrax was taken by Parliament, where this subject was considered as early as 1878. In the year 1880 the Government, alarmed by the large number of cases among workers, appointed a commission to study the situation. In 1893 another official investigation was undertaken. These efforts, however, did not solve the problem, and in the year 1913 the Home Office considered it necessary to appoint a departmental committee for the purpose of investigating anthrax in the textile industries.

In Germany the Government was stirred by the alarming proportions which the disease assumed in the hair factories of Nuremberg and in 1894 an investigation was ordered all over the Empire. Inquiries on a more limited scale had been made as early as 1875.

In Belgium anthrax has been a familiar subject for many years, but it was not until 1900 that Government interest became active. At that time several cases occurred in an important tannery and the Government ordered the medical factory inspectors to make an investigation, which, at first limited to skin and hair industries, was afterwards extended to all other occupations subject to the danger of anthrax.

Moved to action by the number of anthrax cases reported in the tanning industry under the accident compensation law of 1901, the general director of labor in Holland also ordered a painstaking investigation of that industry, the report of which was published in 1913.¹

SYSTEMATIC REPORTING AND RESULTANT DATA.

Illuminating as are most of the studies just mentioned, they cover only limited periods, and emphasize the necessity for more thorough, continuous collection of data. This has been sought in various countries, usually through the enactment of compulsory reporting laws.

GREAT BRITAIN.

Apparently the earliest requirement concerning the reporting of anthrax as an occupational disease is found in section 29 of the British Factory and Workshop Act of 1895,² later superseded by the similar law of 1901.³ Section 73 of the latter act, referring to dangerous and unhealthful industries, requires every medical practitioner called in to visit a patient suffering from lead, phosphorus, arsenic, or mercury poisoning, or anthrax, contracted in a factory or workshop, to report the case to the chief inspector of factories at the Home Office, London. For every notice sent, the physician receives a fee of 2s. 6d. (61 cents), while failure to comply with the law makes

¹ Directie van den Arbeid. De Loonijverheid in Nederland, The Hague. 1913.

² 57 and 58 Vict., ch. 37.

³ 1 Edw. VII, ch. 22.

him liable to a fine of not over 40s. (\$9.73). Similarly the manager or owner of the factory must report every case of any of the above-mentioned diseases to the inspector and to the certifying surgeon for the district. Upon receipt of the report the latter must visit the patient and the place where the case occurred and report to the chief inspector.

The report by the factory management must cover the following points:

1. Name of establishment.
2. Name and address of proprietor.
3. Kind of work done.
4. Nature of the disease.
5. Name and address of the patient.
6. Age and sex.
7. Precise statement as to occupation.

In the report of the factory inspector to the Home Office, which must be sent within seven days after receipt of the report from the certifying surgeon, the sorts of suspected wool, hair, bristles, hides, or skins must be stated, as well as the country of origin.

For the first few years but a small number of cases was reported—only 114, for instance, for the years 1896 to 1899, inclusive. Since that date reporting has been more complete, and larger numbers of cases have been brought to official attention.

The following table is compiled from the annual reports of the chief factory inspector of Great Britain and shows the number of cases of anthrax reported to that official for the years 1900 to 1913 and the number of these cases which were fatal:

TABLE 9.—CASES OF ANTHRAX AND NUMBER OF DEATHS THEREFROM REPORTED TO CHIEF FACTORY INSPECTOR OF GREAT BRITAIN, 1900 TO 1913, BY INDUSTRIES AND YEARS.

[Source: Seventeenth Abstract of Labor Statistics of the United Kingdom, 1915, pp. 124, 125.]

Year.	Wool industry.		Horsehair.		Skins and hides.		Other industries.		Total.	
	Cases re-reported.	Deaths re-reported.	Cases re-reported.	Deaths re-reported.	Cases re-reported.	Deaths re-reported.	Cases re-reported.	Deaths re-reported.	Cases re-reported.	Deaths re-reported.
1900.....	9	2	12	3	9	1	7	1	37	7
1901.....	6	4	9	1	20	5	4	-----	39	10
1902.....	12	2	10	2	11	5	5	-----	38	9
1903.....	20	5	7	1	12	1	8	5	47	12
1904.....	12	1	12	4	18	3	8	2	50	10
1905.....	34	12	7	1	17	4	1	1	59	18
1906.....	24	8	10	5	18	5	14	3	66	21
1907.....	23	3	17	4	12	2	6	2	58	11
1908.....	18	3	10	-----	13	1	6	3	47	7
1909.....	28	3	8	2	18	6	2	1	56	12
1910.....	28	3	6	1	14	3	3	2	51	9
1911.....	35	10	8	1	20	-----	1	-----	64	11
1912.....	31	6	7	-----	8	-----	1	-----	47	6
1913.....	43	4	5	1	19	2	3	-----	70	7
Total.....	323	66	128	26	209	38	69	20	729	150

These data show a marked though irregular increase in the number of cases reported, which appears rather unexpected in view of the several preventive measures introduced during that period. The increase, however, may be due not to the lack or ineffectiveness of protective legislation, but to more extensive use of dangerous materials or to a more satisfactory compliance with the notification law. Probably the fact that the Workmen's Compensation Act of 1906¹ made anthrax a compensable disease has had much to do with securing fuller reports. As will be seen from the table, the frequency of anthrax varies considerably in the different industries. It is significant that in 11 of the 14 years for which the data are given the largest number of cases occurred in the wool industry, which is more developed in England than any of the other industries subject to anthrax. In 6 of these 11 years, also, one-half or more of the total cases of anthrax reported each year occurred in that industry. Next in the prevalence of anthrax is the leather industry. Practically all industrial cases of the disease occur among workers in the wool and leather industries and in animal-hair works; in the remaining occupations anthrax is less frequent.

An important element in anthrax statistics is the death rate. A high rate may mean absence of curative measures, or it may mean lack of familiarity with the symptoms of the disease, which prevents early diagnosis and postpones treatment to a stage when cure is no longer possible. The death rate for the seven years 1900 to 1906 was 25.9 per 100 cases; but a marked improvement took place in the subsequent similar period, when it was only 16 per cent.

More detailed statistics are available for the wool industry of the West Riding of Yorkshire, which is under the supervision of the anthrax investigation board organized for that district. The following table illustrates the situation in that industry:

TABLE 10.—CASES OF ANTHRAX IN THE WOOL INDUSTRY REPORTED TO THE ANTHRAX INVESTIGATION BOARD FOR BRADFORD AND DISTRICT, 1906 TO 1914.

[Compiled from annual reports of the Anthrax Investigation Board for Bradford and District.]

Year ending Oct. 31—	Cases reported.			Deaths reported.
	External.	Internal.	Total.	
1907.....	11	1	12	3
1908.....	8	2	10	3
1909.....	17	1	18	2
1910.....	12	.....	12	1
1911.....	14	5	19	8
1912.....	15	3	18	5
1913.....	20	1	21	3
1914.....	18	.....	18	5
1915.....	14	2	16	2
Total...	129	15	144	32

¹ 6 Edw. VII, ch. 47, third schedule.

Comparison of these data with the data for the wool industry of the whole country for the almost exactly corresponding period of 1906 to 1913 shows that more than one-half of the anthrax cases in this industry occur in the district of the West Riding. The high frequency of anthrax in that district is caused by the use of wool imported from such countries as Persia, Turkey, India, and Russia, where anthrax is endemic and where very little or no attention is given to the requirements of hygiene.

GERMANY.

In another leading European country, Germany, where considerable attention is being given to the subject of anthrax, fairly complete data are obtainable, but only for the last few years. For the years 1894 to 1903 admittedly incomplete statistics are reported by Dr. Legge.¹ He states that in that period there were 901 cases of anthrax, including those in agriculture as well as in manufacturing, of which 128 were fatal.

A great improvement in the collection of information was brought about in 1910, when an order of the Federal Council went into effect, extending to anthrax the notification and other provisions of the act of 1900 relative to diseases constituting a public menace.

Besides the usual data as to name, sex, age, address, and occupation, the following information, important from the medical point of view, must be given:

1. Date when taken ill.
2. Date of first medical treatment.
3. Date of admission to a hospital.
4. Date when the disease was diagnosed by the doctor as anthrax.
5. Was the disease bacteriologically recognized as anthrax? When?
By whom?
6. Nature of the disease: Anthrax of the lungs, anthrax of the bowels, anthrax of the skin? If anthrax of the skin, what part of the body was affected?
7. Has the sick person recovered? Has he died? When?

Even more minutely are taken up the questions of the patient's occupation and of the manner in which infection was transmitted. The method of filling out the schedule calls for cooperation between several governmental agencies, namely, the police authorities, the district medical man or veterinary surgeon, and the factory inspector. A duplicate of the filled-in schedule is sent to the authority intrusted by the provincial government with its verification. Upon verification a copy is transmitted to the Imperial Health Office at Berlin, where it must be received within two weeks of recovery or death of the patient.

¹ T. M. Legge, in *The Lancet*, Mar. 18, 1905, p. 692.

The statistics obtained under this law are published annually and are of more interest than the English figures because they include all cases, nonoccupational as well as occupational. Up to the present, figures are available only for the years 1910 to 1912.

TABLE 11.—CASES OF ANTHRAX REPORTED TO THE IMPERIAL HEALTH OFFICE OF GERMANY, 1910 TO 1912.

[Compiled from Reichs-Arbeitsblatt, July, 1914, p. 588.]

Industry.	1910			1911			1912		
	Cases reported.	Deaths reported.	Deaths per 100 cases.	Cases reported.	Deaths reported.	Deaths per 100 cases.	Cases reported.	Deaths reported.	Deaths per 100 cases.
Agriculture.....	121	12	.....	142	16	.....	114	10	.....
Cattle dealers, veterinarians, and flayers.....	14	.....	.....	16	1	.....	17	1	.....
Tannery and other leather workers.....	103	19	.....	75	10	.....	78	7	.....
Hair and brush workers.....	15	3	.....	19	4	.....	21	4	.....
Wool combing.....	1	.....	.....	.....	.....	.....	.....	.....	.....
Miscellaneous.....	9	2	.....	9	5	.....	16	6	.....
Total occupational.....	263	36	13.7	261	36	13.8	246	28	11.4
Total anthrax.....	287	40	13.9	281	40	14.2	274	36	13.1

Taking the cases in the last four groups as those of anthrax in manufacturing pursuits, we obtain for the year 1910, 128 such cases; for 1911, 103 cases; and for 1912, 115. A comparison of the individual occupations shows that agriculture, followed by the leather industry, heads the list in each of the three years. The death rate is somewhat higher than that shown by the English figures (17.6, 17.2, and 12.8) for the corresponding years; it is also higher for the nonoccupational group than for the occupations, which is true in other countries also. This is explained by the comparative infrequency of nonoccupational anthrax and consequent lack of familiarity with the symptoms on the part of the victims and their physicians.

Owing to the brief period covered by the data no conclusions can be drawn as to fluctuations in the prevalence of the disease, but the situation in the leather industry is worth noting. The number of cases dropped from 103 in 1910 to 75 in 1911, and to 78 in 1912. This was probably due to the effective preventive regulations for that industry which went into effect in the latter part of 1910.

The distribution by sex of all cases reported in the three years was as follows:

Year.	Males.	Females.	Total.
1910.....	257	30	287
1911.....	264	17	281
1912.....	254	20	274

The small number of cases among women is explained by their more limited employment in the occupations subject to anthrax.

FRANCE.

In France, also, anthrax statistics are of a very recent origin. They are now being collected as a result of the ministerial order of July 20, 1910, but, as in England, only cases of industrial anthrax are included. For the years 1910 to 1912 the cases reported were distributed among the industries as follows:

TABLE 12.—CASES OF ANTHRAX REPORTED IN FRANCE, 1910 TO 1912.

[Compiled from Reichs-Arbeitsblatt, July, 1914, p. 589.]

Industry.	1910	1911	1912
Leather.....	36	23	22
Wool.....	10	7	6
Hair.....	4	3	5
Other.....	4	9	5
Total.....	54	42	38

According to sex the cases were distributed as follows:

Year.	Males.	Females.	Total.
1910.....	39	15	54
1911.....	35	7	42
1912.....	29	9	38

HOLLAND.

Until 1905, when it was decided that workmen suffering from anthrax should receive indemnity in accordance with the workmen's compensation act, there was no obligation upon either employers, patients, or physicians to report cases of the disease. Nevertheless, subsequent inquiry in North Brabant, the principal seat of the Dutch tanning industry, yielded the following data:

TABLE 13.—CASES OF HUMAN ANTHRAX REPORTED IN HOLLAND, 1898 TO 1911.

[Source: Directie van den Arbeid. De Loonijverheid in Nederland, The Hague, 1913, p. 115.]

Year.	Total cases reported.	Cases among tanners.	Fatal cases.	Year.	Total cases reported.	Cases among tanners.	Fatal cases.
1898.....	2	2	.....	1906.....	5	5	.....
1899.....	1	1	.....	1907.....	9	9	1
1900.....	2	2	1	1908.....	5	4	.....
1901.....	.....	.....	.....	1909.....	9	8	1
1902.....	2	2	.....	1910.....	5	5	.....
1903.....	.....	.....	.....	1911.....	3	3	.....
1904.....	2	2	.....	Total.....	47	45	4
1905.....	2	2	1				

The influence of the compensation law in encouraging the reporting of cases is clearly seen in the figures for the later years. The general director of labor estimates that in the tanning industry there are annually, per 1,000 workmen, 4.7 cases of infection and 0.3 deaths.

In 1911 a new labor code was enacted, section 21 of which requires the reporting of occupational diseases. The reports are to be sent to the general director of labor within eight days of the diagnosis. For each report a fee of 22 cents is paid, and a fine of \$20 is provided for failure to comply with the law. The report is made according to a prescribed form, giving name, sex, age, and residence of the patient, also the diagnosis, nature of establishment, kind and duration of work, and other necessary data. An interesting educational section of the law requires the doctor to have a manual describing the causes and symptoms of each disease to which the statute applies, as well as the occupations in which the disease may occur.

For the year 1912, 16 cases of industrial anthrax were reported, 7 of which occurred among brush workers.¹ These figures are probably incomplete, as is usually the case with data obtained for the first year of the operation of a law.

ITALY.

Data for Italy, where anthrax is reportable as an infectious disease, show tremendous prevalence of the disease. Sclavo gathered, from 1880 to 1890, records of 24,052 cases among human beings, of which 5,812 were fatal. These figures are carried down to the end of 1904 in the following table:

TABLE 14.—RECORDED CASES OF HUMAN ANTHRAX IN ITALY, 1890 TO 1904.

[Source: C. H. W. Page, British Industrial Anthrax, in Journal of Hygiene, November, 1909, p. 291.]

Year.	Cases.	Deaths.	Deaths per 100 cases.	Year.	Cases.	Deaths.	Deaths per 100 cases.
1890.....	2,047	526	25.7	1899.....	2,672	461	17.3
1891.....	2,241	645	28.8	1900.....	1,867	330	17.7
1892.....	2,077	650	31.3	1901.....	1,992	341	17.1
1893.....	2,461	598	24.3	1902.....	3,528	403	11.4
1894.....	2,400	635	26.5	1903.....	3,423	397	11.6
1895.....	2,179	621	28.5	1904.....	3,104	355	11.4
1896.....	1,985	453	22.8				
1897.....	2,123	460	21.7	Total.....	36,426	7,308	20.1
1898.....	2,327	433	18.6				

¹ Walter Abelsdorff: Gewerbliche Milzbrandvergiftungen in Deutschland, Frankreich, England, und Holland, 1915, p. 9.

For later years the data have been published irregularly, but the following are obtainable:¹

Year.	Cases.
1905 -----	2, 893
August-December, 1908 -----	2, 188
1909 -----	2, 736
1910 -----	2, 252
January-May, 1911 -----	364

Most of these cases, it should be said, arise in the nonmanufacturing districts.

RUSSIA.

In Russia epidemics of the malady are common, under the name "Siberian pest," 528 persons having died of it from 1867 to 1870 in the single Province of Novgorod. Javorsky is authority for the statement that in the whole country more than 10,000 cases are annually observed. Even this appalling figure would seem to be too low, for Popov² declares that in the years 1904 to 1908, inclusive, there were 80,498 cases, or more than 16,000 a year. As in Italy, however, it is believed that the majority of cases occur outside of the manufacturing industries.

The data for other European countries are even less reliable. In Austria the law of April 14, 1913, made human anthrax, among several other infectious diseases, reportable. Earlier reports of the factory inspectors give the following data for the years 1903 to 1906: 1903, 15 cases; 1904, 5 cases; 1905, 13 cases; 1906, 4 cases.

These fluctuations, however, seem improbable, and the figures as a whole appear to be too low, for in the report for 1907 a factory inspector stated that in the brush factories of his district alone 50 cases of anthrax had occurred in the preceding 10 years.

PROTECTIVE LEGISLATION.

Absolute prohibition of the importation of animal materials from countries where anthrax is known to exist, unless such materials are first thoroughly disinfected, would probably put an effective stop to the ravages of the malady among industrial workers. No country, however, has yet found such a step either commercially or administratively possible. Many of them—France, Germany, Great Britain, Holland, Hungary, Italy, and Spain, for instance—do prohibit the employment of women or of children of different ages in dangerous processes, but the great mass of European legislation on occupational anthrax is confined to more or less careful general regulation of the hazardous trades and occupations.

¹ Compiled from *Rivista di Igiene e di Sanita Publica*.

² H. B. Popov: *Russki Vrach* [The Russian Physician], June 14, 1914, p. 848.

WOOL, HAIR, AND BRISTLES.

Of the industries in which there is danger of anthrax, those which involve the handling of wool, hair, and bristles have been most widely and thoroughly brought under Government regulation.

In England the wool industry has reached a high degree of development, and much of its raw material comes from Persia, East India, China, and other countries where anthrax is endemic and precautionary measures are almost unknown. Its attention having been drawn by the frequency of anthrax among wool sorters, the English Government called in 1884 a conference of public health officials, representatives of the workers, and wool merchants. At this conference the first tentative set of regulations for the wool industry was adopted. In 1897 instructions were published for wool-sorting and in 1900 for wool-dyeing establishments.

In 1905 the Home Office issued regulations which codified and amplified the earlier rules. They refer¹ to the work of sorting, "willeying" (willowing), washing, combing, and carding wool, goat hair, and camel hair, and the incidental processes. Only certain specified materials, imported chiefly from Asiatic countries, come under these regulations. Detailed instructions are given for the opening and handling of wool or hair. Each bale may be opened only after it has been thoroughly steeped in water and only by men skilled in judging the condition of the material; screens, sorting boards, and willowing machines of specified construction are required. Several kinds of materials must not be sorted except in a damp state and after being washed. Goods must be stored only in places set apart for the purpose. Detailed regulations are set forth for ventilation, cleanliness, disposal of waste, working clothes, and requisites for treating scratches and slight wounds. Strict requirements apply to the places where unwashed wool or hair of the kinds named is handled or stored. For persons working in those rooms there must be sufficient washing accommodations, with soap, nail-brushes, and towels, and proper places for keeping food and clothing. A worker having an open cut or sore must not be employed in any such room.

The regulations prescribed for the employers are followed by instructions to the workers, who are also made responsible for compliance with the rules. Attached to the regulations is a note describing the dangers of anthrax and urging personal cleanliness.

These regulations apply only to the more dangerous kinds of wool, and therefore protect only part of the woolworkers of the United Kingdom; all other kinds of wool are disregarded, as, for instance, those coming from South Africa and South America, which

¹ See pp. 137-140.

are not classified as "dangerous," but which also cause anthrax, although less frequently than the materials mentioned by the regulations. The insufficiency of the regulations is, indeed, generally agreed upon, and revision is now being considered by the departmental committee on anthrax.

Prevention of anthrax in the trades using the coarser kinds of hair was not taken up by the British Government until several years later, probably because the danger was less conspicuous than in the wool industry. Processes involving the use of horsehair from China, Siberia, or Russia were made subject to regulation in 1908.¹ These countries are specified because hair shipped from there is considered particularly dangerous. These rules contain for the first time the significant requirement of disinfection, which may be carried out by steam or by any other method certified by a Government-recognized laboratory. Rules are also set forth for the opening, sorting, and storing of nondisinfected material, exhaust drafts of a prescribed kind are required, and instructions are given for the disposal of dust collected during the various processes. The requirements with regard to working clothes, respirators, supplies for treating wounds, cloak and lunch rooms, and lavatories are similar to those contained in the regulations for work on wool. As in those regulations, also, the workers are called upon to observe the prescribed rules. An important factor in the success of these measures is the provision which imposes a penalty not only upon the recalcitrant employer but also upon the worker who fails to observe the law. This provision is found in section 85 (2) of the Factory and Workshop Act of 1901: "If any person other than an occupier, owner, or manager, who is bound to observe any regulations under this act, acts in contravention of, or fails to comply with the regulations, he shall be liable for each offense to a fine not exceeding £2 [\$9.73]." ²

In Germany industrial anthrax appears to be particularly prevalent among hair and brush workers, and detailed legislation for that industry was secured fairly early. The question is taken up by an order of the Federal Council of October 22, 1902,³ which superseded a similar order of January 28, 1899. The German order agrees in its main points with the British regulations. Both require disinfection of materials, isolation of nondisinfected goods, special working clothes, and dressing rooms and lunch rooms for the workers who come in contact with raw products. Factory sanitation and personal hygiene are also prescribed along similar lines. But, contrary to the English law, the German decree applies not only to goods coming

¹ Appendix B, p. 141.

² I Edw. VII, ch. 22.

³ See Appendix B, p. 145.

from certain countries but to all horse, cattle, and goat hair and pigs' bristles of foreign origin. It also differs from the English law in several other important points. For instance, public disinfection stations are established, indicating great interest on the part of the Government. The employer is required to furnish the workers facilities for warm bathing twice a week and to see that each individual wears the working clothes assigned to him. Perhaps the most significant provision is that allowing the employer to discharge without notice and without liability for breach of contract any worker who, after repeated warning, persists in violating the rules. In addition to its salutary disciplinary effect upon the employee, this provision is of considerable consequence in a country like Germany where anthrax is compensated as an industrial injury, as it safeguards the employer's financial interests against the employee's possible carelessness.

French regulations for the prevention of anthrax in the industries under discussion are contained mainly in the decree of October 1, 1913,¹ which superseded all earlier laws. This decree, like its predecessors of 1908 and 1910, does not follow the English or German method of special regulations for each industry or allied group of industries, but applies to all establishments in which the employees are menaced by anthrax, including those "where skins, fur, horsehair, hogs' bristles, wool, horns, or bones, or other animal products liable to be infected" are handled. Special attention is given to the protection of workers engaged on nondisinfected material or on the process of disinfection. The methods of disinfection used must, as in England and Germany, be officially approved. The rules referring to sanitation in the work place, working clothes, dressing rooms, lavatories, and personal cleanliness are very similar to those prescribed by the two countries already discussed, but lack their minuteness and definiteness. Walls, floors, tables, and benches, for instance, must be washed, not at definitely stated intervals, but "whenever necessary," or "as often as may be necessary," and must be "frequently" disinfected. The vital matter of dust prevention, which is taken up with considerable care in England and Germany, has received little thought from the French authorities. Instead of requiring dust-removing devices the law simply states that wool, horsehair, other animal hair, and bristles must be handled, "whenever possible," in closed vessels. If this is impracticable, as for instance, in the case of opening bales or beating, the operations must be carried out "under such conditions as will allow the collection of all offal and its subsequent destruction."

¹ See Appendix B, p. 143.

Another preventive device which escaped the attention of the French lawmakers is that of imposing some responsibility upon the workers. Overalls and respirators provided by the firm can not serve their purpose unless they are worn, and the best equipped lavatories and dressing rooms are useless if the worker ignores them. Consequently, pressure must be exercised not only on the employer but on the worker also. French employees, however, are merely asked, through regulations posted in the workrooms, to use the various working articles provided for them, as well as the washstands and dressing rooms, to clean themselves before leaving the premises, and to bring no food into the workrooms.

In Hungary workers in brush factories and in all establishments where horse and cattle hair and pigs' bristles are manipulated are protected against anthrax by an order of the minister of commerce, issued on May 18, 1903. This order is practically the same as the order of the German Federal Council of October 22, 1902.

The majority of cases of anthrax in Belgium have occurred among brush workers, and this circumstance prompted the royal order of August 20, 1908. In striking contrast to the previously discussed legislation, this order consists of only two short sections and merely prescribes, imperatively, the disinfection of hair in a manner "sufficient to kill the anthrax spore." Medical inspectors are to test, through samples of disinfected hair, the effectiveness of the method used.

HIDES AND SKINS.

Another large group of industries in which the need of Government activity against anthrax has been felt by several European countries is that connected with hides and skins, especially in the processes of tanning. The problem of infection from imported hides and skins was taken up in Great Britain in 1899. In 1901 rules were published by the Home Office for establishments using dry and dry-salted hides and skins imported from China or from the west coast of India.¹ It was required that provision be made for overalls and gloves, for the keeping of food and clothing, for washing accommodations, and for the dressing of wounds. Notes are added to the rules, one calling the worker's attention to the dangers of anthrax, and another reminding him of his obligation to observe the law.

Prussian workers engaged on imported hides and skins are covered by a ministerial order issued on May 9, 1902. It briefly describes the nature of anthrax and its danger to the worker and emphasizes the necessity of precautionary measures.²

¹ See Appendix B, p. 136.

² See Appendix B, p. 148.

A later and more effective measure was the decree of the Prussian minister of commerce dated December 20, 1910. This directs factory managers to adopt for the protection of tanners the regulations issued by the Leather Trade Association, which were based on the latest scientific investigations and were framed in conformity with the requirements of the Imperial Health Office.¹ The rules apply to raw sheep and goat skins and to all skins and hides imported in a dry, raw state. These materials must be kept in isolated storerooms. Detailed rules are prescribed for the sanitation of the storerooms and for the transportation and handling of the goods. The familiar instructions with regard to working clothes, lavatories and lunch-rooms are also found, as well as an interesting rule forbidding the worker to enter the lunch room, to eat any food, or to leave the premises until he has changed his working clothes and has thoroughly washed the face, head, hair and beard, neck, hands, and arms. Each new worker receives a copy of regulations for the prevention of accidents, and instructions concerning anthrax.

Other States of the German Empire have also accepted these regulations. Stuttgart, the capital of the Kingdom of Wurttemberg, for instance, is an important center of the glove industry. There were revealed in the first year of the operation of the compulsory notification law of 1909 22 cases of anthrax, of which 2 were fatal. This indicated a greater prevalence of anthrax among tannery workers than was shown by earlier data, and as a result the regulations for the leather industry were introduced by ministerial order.²

The French regulations for tanneries have been discussed in the preceding section.

Incidentally it may be remarked that in Italy, the home of the Sclavo serum and the scene of much intelligent private activity against anthrax, the Government remains practically inactive on the question. Despite the appalling prevalence of the disease no legislation exists for its prevention among industrial workers.³ In 1911, in accordance with a decree of the minister of agriculture, industry, and commerce and a decision of the administrative council of the national workmen's accident insurance fund, prizes were offered for the best essays on a number of topics connected with industrial safety and hygiene. One of the subjects was prevention of anthrax among workers employed in the transportation and treatment of skins, but none of the essays submitted were deemed worthy of the prize.

¹ See Appendix, p. 149.

² Bulletin of the International Labor Office, Vol. VIII, 1913, p. XVI.

³ L. Devoto and F. Massarelli: *Il Charbonchio Professionale*, *Il Lavoro*, July 15, 1914, p. 194.

COMPENSATION FOR ANTHRAX AS AN INDUSTRIAL INJURY.

Thorough as is much of the administration of European factory law, the "policing" method alone has not been depended upon for the enforcement of regulations for the prevention of anthrax. The method of cooperative pressure on employers through workmen's compensation, which has proved so effective in reducing work accidents, while at the same time it safeguards the economic position of the injured or of their dependents, has already been applied to a number of occupational diseases, but to none so early or so widely as to anthrax. At least five European countries (Great Britain, Germany, France, Italy, and Holland), and two Provinces of one of these (South Australia and Ontario), already provide compensation for this disease.¹

The British Workmen's Compensation Act of 1897, the first of its kind in any English-speaking country, established indemnity for personal injury "by accident" arising out of and in the course of employment. In 1905 the House of Lords was called upon to determine, on an appeal, whether the dependents of a workman who had died of anthrax were entitled to compensation under this act. The House decided in the affirmative, Lord Macnaghten saying:

It is plain, I think, that the mischief which befell the workman in the present case was due to accident, or rather, I should say, to a chapter of accidents. It was an accident that the noxious thing that settled on the man's face happened to be present in the materials which he was engaged in sorting. It was an accident that this noxious thing escaped the down draft or suck of the fan which the Board of Trade, as we were told, requires to be in use while work is going on in such a factory as that where the man was employed. It was an accident that the thing struck the man on a delicate and tender spot in the corner of his eye. It must have been through some accident that the poison found entrance into the man's system, for the judge finds that there was no abrasion about the eye, while the medical evidence seems to be that without some abrasion infection is hardly possible. The result was anthrax, and the end came very speedily. Speaking for myself, I can not doubt that the man's death was attributable to personal injury by accident arising out of and in the course of his employment. The accidental character of the injury is not, I think, removed or displaced by the fact that, like many other accidental injuries, it set up a well-known disease, which was immediately the cause of death, and would no doubt be certified as such in the usual death certificate.²

¹ In addition it should be remembered that in most European countries, including Austria, Germany, Great Britain, Holland, Hungary, Luxemburg, Norway, Roumania, Russia, and Serbia, anthrax is covered by compulsory health-insurance laws, while in six countries, Belgium, Denmark, France, Iceland, Sweden, and Switzerland, a limited amount of protection is given by systems of subsidized health insurance.

² *Brintons (Ltd.) v. Turvey*, 92 L. T. R., 578 (1905).

Other cases of occupational disease also arose which caused litigation under the law, so that when Parliament enacted the present British compensation statute in 1906 it included a list of six trade diseases (since expanded to 25) which were to be compensated on the same terms as accidents. One of these six was anthrax.¹ Section 8 of the law states that if the certifying surgeon for the district testifies that a workman is suffering from a disease to which the act applies and is thereby either unable to earn full wages or is suspended from work, or if death is caused by any such disease and "the disease is due to the nature of any employment in which the workman was employed at any time within the 12 months previous to the date of the disablement or suspension, whether under one or more employers, he or his dependents shall be entitled to compensation under this act as if the disease or such suspension as aforesaid were a personal injury by accident arising out of and in the course of that employment."

In the seven years 1908 to 1914, the only years for which data are available, 233 cases of anthrax have been compensated under the law. The following table shows the distribution of the cases by year and by industry:

TABLE 15.—CASES OF ANTHRAX COMPENSATED FOR THE FIRST TIME DURING THE YEAR UNDER THE BRITISH WORKMEN'S COMPENSATION ACT, 1908 TO 1914.

[Compiled from Home Office annual reports on statistics of compensation and of proceedings under the Workmen's Compensation Act, 1906, and the Employers' Liability Act, 1880.]

Year.	Cotton.	Wool, worsted, and shoddy.	Other textiles.	Engineering and ship-building.	Other metal work.	China and earthenware.	Miscellaneous factories.	Docks.	Total.
1908.....	1		4	1		1	8	8	23
1909.....		6	3		1		7	5	22
1910.....		19	1				5	10	35
1911.....		20	1				5	4	30
1912.....		26	5				6	6	43
1913.....		24					18	2	44
1914.....		16	1		1		13	5	36
Total....	1	111	15	1	2	1	62	40	233

It is interesting to note, in connection with the British experience, that the example of the mother country has encouraged both South Australia² and Ontario³ to write into their compensation laws the principle of indemnity for occupational diseases, each Province adopting the schedule of six compensable diseases, including anthrax, with which Great Britain began.

The terms of the German workmen's compensation code cover only injuries by "accident," but, as in Great Britain under the law of

¹ 6 Edw. VII, ch. 47, third schedule.

² South Australia, 2 Geo. V, No. 1053 (1911).

³ Ontario, 4 Geo. V, ch. 25 (1914).

1897, anthrax is held to be an accident and is compensated as such.¹ The same situation obtains in Holland by a decision of 1905,² and in France.³ In the last-named country the question of indemnity for trade diseases came up soon after the enactment of the compensation law in 1898, and a committee on industrial hygiene was appointed under the Ministry of Commerce to study it. The commission's report, published in 1903, concluded with regard to anthrax:

Anthrax has always an external origin and is due to infection by a microbe; this infection takes place at a given moment, and it certainly furnishes the element of suddenness required by the law of all accidents which come under the act of 1898.⁴

Since the publication of this report the French courts have reversed their previous opinion, and in the years 1903 to 1909 they decided four contested cases which came before them in favor of the injured workers.

The movement abroad in favor of compensation for occupational anthrax, as well as for other trade diseases, is not confined to these seven countries and parts of countries. Section 68 of the Swiss industrial accident insurance law of 1912 empowers the Federal Council to "prepare a list of substances, the production or employment of which occasions dangerous diseases. Every disease exclusively or essentially due to the action of one of those substances in an enterprise subject to insurance is deemed an accident within the meaning of the present law." It can hardly be doubted that anthrax would find a place on a list of this kind, but apparently the Federal Council has not yet exercised its power.

¹ Pickenbach, *Beitrag zur Milzbrandkrankung in der Lederbranche*, Aertzlicher Sachverständigen Zeitung, 1914, No. 18, p. 365.

² H. A. Van Ysselsteyn, *General Director of Labor: Anthrax*, 1912, p. 1.

³ J. Cavaillé: *Le Charbon Professionnel*, Paris, 1911, p. 344.

⁴ France, *Commission d'Hygiène Industrielle, Maladies professionnelles*, Paris, 1903, p. 140.

CHAPTER VI.

PRESENT STATUS OF THE PROBLEM OF DISINFECTION.

It is obvious that the success of the extensive and energetic campaign against occupational anthrax depends to a considerable degree on the effectiveness of methods of sterilizing industrial materials. The significance attached to the question of disinfection has stimulated numerous investigations in the more advanced countries. The work is chiefly done in private laboratories, but important experiments have also been made under the auspices of the United States Bureau of Animal Industry and of the Imperial Health Office in Germany, while facilities for such work are furnished by the Home Office in England.

The task of finding an adequate and practicable disinfectant is greatly complicated by several factors. For instance, various kinds of materials require different modes of treatment. The cost of the disinfectant and the time of exposure necessary for destroying the bacilli and spores are also essential considerations, since an expensive disinfectant, or one acting only slowly, will be rejected by the manufacturers. Still more important is the effect of the disinfectant on the material, since it has been shown that a large number of disinfectants otherwise desirable can not be applied without injury to the goods.

Of the materials liable to convey anthrax to the workers, bristles, horsehair, goat hair, and a few other kinds of hair have proved most susceptible to disinfection. A number of methods have been proposed, three of which are considered the most effective and the most acceptable for industrial purposes. These are: (1) Exposure to steam for a period varying according to temperature and atmospheric pressure; (2) boiling in water for two hours; and (3) boiling for at least 15 minutes in a 2 per cent solution of permanganate of potassium with a subsequent bleaching in 3 to 4 per cent sulphuric acid.

In the disinfection of wool much less has been accomplished. Up to the present no disinfectant has been found entirely satisfactory for industrial purposes. In England constant and diligent study of various germicides is being made by the Bradford Anthrax Investigation Board, which, after nine years of work, reports:¹ "So far

¹ Anthrax Investigation Board for Bradford and District, Ninth Annual Report, 1914, p. 6.

formaldehyde, in the proportion of 1 per cent of neat or proof strength to 99 per cent of water, with a saturation of the opened material for seven hours, is the only germicide that has been found reliable, and even the effect of this germicide must depend upon the absence of ammonia and of large blood clots. The effect of formaldehyde upon the spinning qualities of the material is, however, very marked, and this germicide can only be recommended for extreme cases of infected wool or hair." Further experiments are being made.

Steam disinfection of wool was also the subject of a series of experiments by the staff of the board. The results have brought out the fact that while steam succeeds in destroying the germs its effect is to discolor light-colored material and to turn yellow white. The wool becomes brittle, its elasticity and luster are considerably affected, and the strength of the fiber is also somewhat impaired. As a result a committee of the board agreed that "disinfection by steam can not be applied to ordinary wool or hair except under conditions that would stop any trade in the sorts so treated."¹

However, even the officially approved methods of disinfection are not considered absolutely effective, and occasionally fail to prevent the occurrence of anthrax. C. H. W. Page, an English authority, expresses himself with considerable pessimism. "That steam is ever likely to be certainly effective in disinfecting horsehair is improbable," he says, "since the damper the steam the better chance of destroying the spores, but the greater the damage to the hair; and the drier the steam the less chance of destroying the spores and the less damage to the hair. These antagonistic results produce a deadlock."² He also criticizes the use of steam on bristles because steam bursts or loosens the bundles, which necessitates an expenditure of time and money for putting them in order again; nor does he find boiling satisfactory, for in the time necessary to destroy the spores—two to three hours—the material would be considerably damaged. His stand on the question of disinfection in general he summarizes in the words: "Great care and constant supervision are necessary to secure satisfactory results, and steam can not be regarded as absolutely certain in effect, though the great bulk of spores are destroyed and the vitality of the rest is diminished."

Very similar is the opinion expressed by another English authority, Legge, who states that to secure certain destruction of all anthrax spores absolute reliance can not be placed on either steam disinfection or simple boiling in the absence of effective supervision; however, the adoption of one or the other is a material safeguard.

¹ Anthrax Investigation Board for Bradford and District, Eighth Annual Report, 1913, p. 23.

² Journal of Hygiene, Industrial Anthrax, 1909, p. 369.

This unreliability of disinfection has attracted official attention in the Grand Duchy of Baden, where, notwithstanding the practice of sterilization, the number of cases of anthrax has increased rather than diminished. Prompted by this circumstance the minister of the interior, by an order which went into effect October 28, 1909, instructed the proper authorities to make annual examinations of fresh disinfected samples of materials used in manufacture.¹ The examinations have shown that disinfection does not kill the spores. Some cases of failure the author attributes either to the wrong construction of the apparatus or to the wrong use of it. The individual characteristics of certain kinds of hair also sometimes impede disinfection. In this connection the author mentions goat hair, which comes in hydraulically pressed bales. Upon unpacking, the whole bale, which owing to the nature of the hair shows hardly any tendency to fall apart, is exposed to steam; naturally the steam can not penetrate very deeply, and after an exposure of one-half hour the temperature 8 inches below the surface is only 114.8° F., which is insufficient for sterilization.

Still greater obstacles are in the way of disinfection of hides and skins. Numerous experiments with these materials have so far failed to discover a reliable and convenient germicide. Sterilization by steam, frequently applied in the hair industry, is impracticable for hides and skins, as it injures them for manufacture. Experiments have been conducted with low-temperature steam disinfection in a vacuum, which does not affect the skins, but the question of the applicability of this method for manufacturing purposes has not so far been settled.

Researches, remarkable for their range and thoroughness, have been made under the auspices of the Imperial Health Office of Germany. Hailer, one of the investigators, states² that disinfection of skins is not an impossibility. Numerous methods have been suggested, but so far they have not been applied outside the laboratory. The high cost of the disinfectants, their poisonous properties, and their more or less deleterious effects on the skins, serve as obstacles to their introduction into industry. Of the several layers of which the animal skin is composed the one used for leather is, according to Hailer, sensitive to a temperature of over 104° F., and also to whole classes of chemical substances, such as the phenols, aldehyde acids, and heavy metal salts—in fact, to the strongest germicides. However, some of the substances contained in the skin,

¹ Laubenheimer, Über die Disinfection von Tierhaaren zur Zerbütung von gewerblicher Milzbrand, Zeitschrift für Hygiene und Infectious-Krankheiten, 1912, Vol. LXX, pp. 324, 325.

² E. Hailer, Die Abtötung von Milzbrandsporen an Häuten und Fellen durch Salzsäure-Kochsalzlösungen. Arbeiten aus dem Kaiserlichen Gesundheitsamte. Berlin, 1914, Vol. XLVII, p. 69.

chiefly the albuminoids, make insoluble compounds with these chemicals, and as a result the skins change in appearance and become less valuable for manufacture. Numerous efforts for the removal of these difficulties have met with little success.

At present there are two methods of disinfection which give promise of meeting the necessary requirements; neither has yet been applied on a large scale, but one, recommended by Seymour-Jones of England, chairman of the International Commission for the Preservation, Cure, and Disinfection of Hides and Skins, seems to be meeting with more approval than the other. This process consists in soaking the dry skins for 24 hours in a 1 to 5,000 solution of bichloride of mercury to which is added a 1 per cent solution of formic acid. After this treatment the skins are transferred for an hour or so to a saturated solution of common salt in water. The acid helps to render the bichloride effective because it prevents the formation of the insoluble albuminate of mercury, and also because by its penetrating action the fluid is carried into the center of the mass of any organic material that may serve as a protection for the spores.

The process has been the subject of an exhaustive investigation by Constant Ponder, who considers it simple, cheap, and effective, and "believes that it holds out greater promise of success than any process hitherto suggested."¹ He suggests that the sterilization be carried out in the port of shipment.

The other process was discovered by a German scientist, Schattenfroh. This investigator recommends that hides and skins be soaked for six hours at a temperature of 104° F., or for two days at a temperature of 68° F., in a 2 per cent solution of hydrochloric acid to which a 10 per cent solution of ordinary salt is added. For practical reasons he considers the former method superior. He maintains that no injury is done to the skins by this process?

In the United States numerous studies of disinfection against anthrax have been made by the Federal Bureau of Animal Industry, as well as by the National Association of Tanners and by the American Leather Chemists' Association, at whose meetings the problem is the subject of frequent reports and discussions. In 1910 John H. Yocum, of the leather chemists' organization, pointed out that because of the action of the mercury salt in forming insoluble compounds with albuminoids and thereby depriving itself of further power to act on bacteria, immersion in a simple 1 to 1,000 solution of bichloride of mercury as then required by the Government could "not possibly be effective." He proposed modifying the process by

¹ Constant Ponder: A Report to the Worshipful Company of Leather Sellers, etc., 1911, p. VI.

² E. Hailer: Die Abtötung von Milzbrandsporen an Häuten und Fellen durch Salzsäure-Kochsalzlösungen. Arbeiten aus dem Kaiserlichen Gesundheitsamte. Berlin, 1914, Vol. XLVII, p. 69.

adding the bichloride to a saturated solution of common salt, which would prevent interference with the germicide. This method, however, he found efficacious only for wet salted hides. For dry hides he declared it impracticable because of the long time the fluid required for penetration, and recommended instead the Seymour-Jones process, 1 to 5,000 bichloride of mercury with 1 per cent formic acid. This latter process, Yocum estimated, would entail an expense of about 7 cents a hide, which he held would be more than equalized by economies in the selection and tanning of hides which it would make possible. If the process were carried on at the point of shipment, it was further pointed out, shippers would not be likely to dry the hides out again, so that many of the hides now received in the "flint dry" state would be received as "wet salts," with a consequent reduction of the danger of anthrax infection through flying dust. The paper was circulated for discussion at the following meeting of the tanners,¹ who seemed to feel, however, that it should be subjected to important modification.

Perhaps the most extensive series of American experiments on the subject are those undertaken by F. W. Tilley, of the United States Bureau of Animal Industry.² These experiments tend to show that the original Seymour-Jones process, immersion in 1 to 5,000 mercuric chloride solution with 1 per cent formic acid for 24 hours, is not efficient in killing anthrax spores, even if the germicide is not later neutralized as it would be by other substances in the regular course of tanning. A modification of the Seymour-Jones method, however, by using a mercuric chloride solution of twice this strength (1 to 2,500), with 1 per cent of formic acid, is efficient in 24 hours if there is no neutralization. Hence this latter method, the investigator concluded, seems usable "provided the treated hides are not to be subjected within a week or two to the action of any substances which will neutralize the disinfectant. This would be the case, for instance, if the hides were disinfected at foreign ports before shipment to this country."

Similar researches carried on with the Schattenfroh method, 2 per cent of hydrochloric acid in a 10 per cent solution of sodium chloride, with 48 hours' exposure, are reported to have "proved efficient in every instance." A European bacteriologist,³ however, is quoted as having found that this method works well for thin skins, but that if the skins were "thick and heavily infected he was able, after

¹ John H. Yocum: Disinfection of imported hides. National Association of Tanners, 1913.

² F. W. Tilley: A bacteriological study of methods for the disinfection of hides infected with anthrax spores. Journal of Agricultural Research, Mar. 15, 1915, pp. 65-92; abridged in Journal of the American Leather Chemists' Association, March, 1916.

³ Franz Sevcik: Zur Desinfection von Milzbrandhäuten. In Wiener Aertzliche Monatschrift, Vol. I, No. 3, pp. 127-141.

very effective neutralization, to extract from pieces of the treated hides anthrax spores which were virulent."

In all his work Tilley has emphasized what he considers the extremely slow and superficial action of bichloride of mercury. "Certainly for a short time," he says, "the combination between the bichloride and the spores is what we might call a 'reversible' combination," and the effect of a neutralizing agent, such as the lime used in later processes, "will be to break the combination, and the spores will, so to speak, come to life again."¹ For this reason he recommends a long immersion in a relatively weak solution as preferable to a brief immersion in a stronger solution. On the whole he considers the Schattenfroh method, though not perfect, "far superior to other methods and well worth a trial as a standard method for the disinfection of hides."

On the other hand, a committee report submitted to the annual meeting of the American Leather Chemists' Association in June, 1916, stated that tanners who had tried the Schattenfroh method declared it "positively injurious" to hides, while at the same time bichloride of mercury solution of the strength (1 to 1,000) then required by the Government was complained of as "burdensome in point of cost."² The committee therefore tentatively proposed a new method to supersede both of these. Stating that no cases of anthrax had occurred in glue or hair factories using by-products from American tanneries, the committee suggested that bichloride of mercury 1 to 5,000 or possibly 1 to 10,000, followed by the regular liming process, "will prove effective in rendering the anthrax spores innocuous. If, after further investigation, this proves to be a fact it will meet the situation and relieve the tanners from undue burden or cost." This suggestion had already been conveyed to the Bureau of Animal Industry, and as has been seen a slight modification of the proposed process is embodied in the rules prepared by the Federal authorities, in cooperation with the tanners' committee, later in the year.³

The other products liable to convey anthrax, chiefly bones and horns, are used to a more limited extent than hair, wool, or hides, and danger of infection from them is also comparatively slight. For these reasons their sterilization is less urgent, and it has been almost disregarded in the spirited campaign for protection against the more common carriers of the disease.

¹ Journal of the American Leather Chemists' Association, July, 1916, p. 350.

² C. R. Oberfell: Cure and Disinfection of Hides. Committee report, 1916. Journal of the American Leather Chemists' Association, July, 1916, pp. 333-339.

³ See Appendix A.

CHAPTER VII.

RECOMMENDATIONS FOR CONTROL AND PREVENTION OF ANTHRAX.

The serious difficulties in the way of a satisfactory solution of the occupational anthrax problem have been the subject of considerable expert study. Since it has not yet proved possible to eradicate anthrax even in the countries where the most advanced legislation on the subject is combined with enlightened private activity, additional measures of protection are necessary.

After careful study of the problem several authorities of world-wide reputation have set forth recommendations in which they take up not only the question of anthrax in manufacturing centers, but also in the stock-raising countries of export, and in which the necessity of international action is emphasized.

Of the recommendations published in recent years three sets are conspicuous for their thoroughness and for the extensiveness of the ground covered, and are here given entire.

RECOMMENDATIONS OF SUBCOMMITTEE OF INTERNATIONAL ASSOCIATION FOR LABOR LEGISLATION, 1914.¹

A. It is important (in order to be in a position to know the extent of the risk of anthrax infection in industries and the preventive measures necessary to combat it) that in each country full statistics should be kept of cases which arise.

Such statistics should always supply the following information: Age and sex of the patient; precise occupation; the kind and source of the materials handled at the time of the attack; situation and clinical form of the disease; result.

It is desirable that these statistics should be as wide as possible and cover all cases of anthrax—agricultural as well as industrial.

B. In all premises where the products (wool, hair, bristles, hides, and skins) of animals susceptible of anthrax are stored and handled in the raw state the occupier should post up a notice containing—

(a) An illustration showing the commonest and most characteristic form of external anthrax (malignant pustule);

(b) A brief account of its origin and the typical forms of infection;

(c) A warning to the persons employed as to the importance of personal cleanliness and the necessity of prompt treatment for every lesion, however slight.

¹ Appointed to consider the question of anthrax, in accordance with the decision of the seventh delegates' meeting of the association, 1912.

C. In all premises where wool, hair, bristles, hides, and skins coming from suspected countries are stored and handled in the raw state, the occupier should adopt the following measures. (It will fall to the Government of each country to decide on and classify in one or more schedules, according to the degree of risk and quantity of material imported, the countries to be declared "suspected.")

1. Inspectors of factories should be permitted by the occupier to inspect either the stock book in which is entered the purchase of material for the factory or workshop or a special register with entries as follows: Nature and quantity of material introduced; date of receipt; country of origin; state (whether raw or disinfected) of the products; name of the vendor. And in the case of material said to have been disinfected before introduction into the factory, an approved certificate to that effect.

2. All scheduled raw materials which can be subjected to the operation without damage should be disinfected.

3. Opening of bales of wool, hair, bristles, hides, and skins should always be intrusted to persons skilled in judging the portions which are damaged.

4. Preliminary operations regarded as particularly dangerous should always be carried out in a room, or portion of a room, set apart for the purpose.

(It will fall to the Government of each country, having regard to the different processes of manufacture and manipulation customary in each country and in each industry under regulation, to define what are the preliminary operations to be regarded as dangerous.)

5. Wool and hair sorting should always be carried on so as to permit of the removal of blood clots adhering to the fleece, and of bloodstained portions. These fragments should either be burned or sterilized by a process recognized as efficient.

6. The preliminary manipulations as defined above, which are carried out on dusty material treated in a dry state, should be carried on under an efficient exhaust draft preferably in a downward direction. The dust should never be allowed to escape into the open air.

The dust collected in a special receptacle should either be burned (unless coming from material that has previously been washed) or rendered harmless by treatment, chemical or otherwise.

7. The workrooms in which the preliminary processes are carried on should be kept in a constant state of cleanliness; the floors should be impermeable, and the walls treated in such a way as to permit of thorough washing, or limewashed at least once a year.

The floor, walls, tables, benches, tools, and machines should be frequently cleaned.

8. The occupier should provide for the persons employed in the preliminary manipulations means for securing personal cleanliness; a cloakroom (with arrangements for keeping separate the ordinary clothes from clothing worn while at work) and a lavatory with an abundant supply of water (hot and cold whenever possible), soap, nailbrushes, and towels.

Every person employed in handling raw material should be provided with his own overalls and head covering.

Persons employed in cleaning dust-extracting machines and receptacles for dust should be provided with respirators.

No food or drink should be deposited or partaken of in rooms where dangerous processes are carried on.

9. Medical treatment should be organized on the following lines:

Every person employed having a pustule or pimple resembling anthrax should report the fact without delay at the manager's office, whereupon the occupier, on his part, should cause him to be examined by a surgeon appointed for the purpose.

The name and address of the surgeon should be entered on the notice provided under B, above.

10. Every factory and workshop should be provided with an ambulance box kept in good condition and in a place easily accessible.

11. No person under 18 years of age should be employed in the preliminary operations defined above.

D. It is desirable that in all countries where stock is raised, sanitary regulations drawn up on the same lines should be seriously applied with a view to bring about diminution in the epizootic spread of anthrax, and destruction by efficiently organized methods of all the products or offal of animals that have died of anthrax.

The members of the subcommittee:

DR. KOELSCH, *Chief Medical Inspector, Munich.*

DR. LEGGE, *Medical Inspector, London.*

J. CAVAILLÉ, *Inspector of Labor, Castres.*

RECOMMENDATIONS BY PROF. L. DEVOTO AND F. MASSARELLI.¹

1. Compulsory antianthrax vaccination of animals. The committee can not ignore the fact that such a measure is very difficult if not impossible of execution in foreign countries where anthrax is endemic, and if limited to our own country it can not have the slightest influence in the prevention of occupational anthrax.

2. Concentration of the cargoes of animal material coming from foreign sources in specially designated ports having special and exclusive storehouses for said material, fitted up with smooth walls and floors to facilitate periodical disinfection.

3. Adoption of sanitary regulations for the transportation of said material at the points of disembarkation—regulations which might be formulated as follows:

(a) Isolate from other merchandise the hides, etc., of suspected animals on board sailing vessels and steamboats, and after the discharge of every invoice disinfect the place of storage while in transit.

(b) Use for discharging cargoes of animal material special lighters which, until disinfected, are not to serve for other transportation.

(c) Forbid the transportation of suspected material on the bare shoulder, and furnish laborers with impermeable clothing and head covering, this last to protect securely the throat, back of the head, and face by means of a cape; also supply all facilities for washing after work, soap, etc., if not disinfecting solutions.

Analogous regulations should be adopted in railway transportation.

4. Request the Governments to make compulsory sanitary regulations (after the manner of those established in Germany, France, etc.) obligatory on the part of manufacturers and on the part of workmen in establishments where animal substances are handled.

¹ From an article on *Il Charbonchio Professionale, Il Lavoro*, July 15, 1914, p. 197.

5. Preventive vaccination of the workmen who come into immediate contact with the imported material.

6. Diffuse among the workmen by means of pictures, publications, and models a knowledge of methods for the early recognition of the pustules, and institute a propaganda in favor of using antianthrax serum as a prophylactic and curative agent.

RECOMMENDATIONS BY C. H. W. PAGE.¹

The fact that practically all bristles and horsehair on arrival in this country are centered for a time in two or three London warehouses raises the question whether it would not be possible to disinfect the material before distribution. Were disinfection thus centralized it would be a comparatively simple matter to protect the limited number of people exposed to risk in cutting the knots of the bundles and spreading the horsehair out for disinfection; then the necessity for formal regulations in horsehair and brush-making factories and workshops in a great measure would be obviated. The manufacturers would gain in being freed from risk of anthrax among their employees and, further, would be able to use hair that many of them have preferred to discard on account of its dangerous properties.

With regard to the measures introduced in Germany a few years ago, and quite recently in England, more stress might be laid on the necessity of washing, use of nailbrush, keeping the nails short; in washing, the use of an efficient disinfectant is advisable; for this purpose Cyllin does admirably, being compatible with soap. Experience shows that soap and water are the true safeguards after handling infected material, and those who use the same stuff after disinfection should wash hands, face, and neck before going home to a meal. By these means, too, the likelihood of workers carrying infection outside would be diminished. The ignorance and carelessness of the workers are undoubted factors in the spread of anthrax. The use of overalls and gloves, though unpleasant and disliked by the workpeople, yet is very necessary, as cases quoted show.

Facilities for bacteriological examination given by the Home Office since 1899 for verification of doubtful cases might with advantage be extended to examination of suspected samples of hair, etc.

It would be advisable to require the registrar to communicate with the coroner in all fatal cases of anthrax.

When possible, walls and pavements of factories and workshops should be painted or glazed so as to be easy to clean and disinfect.

Early diagnosis of anthrax being difficult, it is essential for a medical man to be attached to each factory, or group of factories, to whom all cases may be referred, so that in making a diagnosis the nature of the employment may be taken into consideration. By this timely vigilance, remedies, harmless in any case, may be used with far greater prospect of success.

The duties of certifying factory surgeons might be extended with advantage to include the above work, and that there might be no delay they should be supplied with serum by the Home Office. The surgeons should collect samples of suspected material for bacteriological examination, should undertake the entire treatment of all cases of anthrax, and, in conjunction with the local factory inspector, conduct an inquiry into the source of infection.

¹ From summary of article on British Industrial Anthrax, *Journal of Hygiene*, December, 1909, pp. 390-395.

Employees absent from work should report to the employer the cause, and in the case of illness of any kind the employee should be visited at once by the certifying factory surgeon.

The employer should exclude as far as possible workpeople with cuts or abrasions unless suitably covered, and for the carrying out of all regulations each factory and workshop should be supplied with, or compelled to supply, means for dressing small cuts, etc.

All cases of human anthrax, whether industrial or agricultural, should be notified. Both human and animal cases of anthrax should be notified to one authority, or to both the board of agriculture and the Home Office, so that if thought advisable the inquiry may be made in common.

Human anthrax being so closely associated with animal anthrax, more systematic efforts should be made (1) by limiting the spread of the disease in nature, and (2) by the immunization of animals against anthrax to exterminate the disease among animals.

It is necessary to dispose of the carcasses without shedding of blood, so that no part may be used, either (1) by burning, or (2) by deep burial, preferably in quicklime. These methods are equally effective, but perhaps for smaller carcasses burning is to be recommended and for larger ones deep burial. All places likely to have been contaminated with any discharges should be thoroughly disinfected, as with 1 in 1,000 corrosive sublimate.

Investigations should be undertaken in each country or by some international organization, to determine accurately the nature and extent of anthrax districts, which should be then kept under supervision and, where possible, drained or rendered innocuous by other means. Such measures would result in a considerable reduction in anthrax among animals and consequently among human beings. Such an organization would give warning of the prevalence of anthrax in these districts, so that export of infected material might be controlled.

Dust from horsehair factories is not infrequently sold. * * * Hence it is necessary to prevent the sale of dust arising in the manipulations of dangerous or nondisinfected raw animal products and to do this separate tables and rooms should be used for such material. Such dust should be burned. The effluent from wool, hair, and skin factories should be rendered inert by some reliable process, such as prolonged boiling, before being discharged, or treated by a suitable strength of some such disinfectant as Cyllin.

Other general measures, as notification of all cases of deaths of animals from any acute disease and of those rendering necessary slaughter on the farm are desirable. A fee should be paid for notification and compensation for animals slaughtered, while failure to comply with these regulations should be punishable by a heavy penalty.

Animals, except in emergencies, should not be slaughtered or their carcasses disposed of except on licensed and inspected premises, and, in all cases of animals slaughtered otherwise than by butchers in the ordinary course of their business, a veterinary should inspect the carcasses and give a certificate of the cause of death or disease, stating the uses to which the carcass may be put, a copy of the certificate to be forwarded to the board of agriculture as well as to the medical officer of health.

Information should be furnished to factory and market officials; no butcher or knacker should purchase the carcass without having seen the certificate.

APPENDIX A.—RULES AND REGULATIONS IN THE UNITED STATES.

UNITED STATES: TREASURY DEPARTMENT AND DEPARTMENT OF AGRICULTURE JOINT ORDER NO. 1. REGULATIONS GOVERNING THE CERTIFICATION AND DISINFECTION OF HIDES, FLESHINGS, HIDE CUTTINGS, PARINGS, AND GLUE STOCK, SHEEPSKINS AND GOATSKINS AND PARTS THEREOF, HAIR, WOOL, AND OTHER ANIMAL BY-PRODUCTS, HAY, STRAW, FORAGE, OR SIMILAR MATERIAL OFFERED FOR ENTRY INTO THE UNITED STATES, 1916.

[Effective January 1, 1917.]

WASHINGTON, D. C., *October 21, 1916.*

Under authority of the act of Congress approved October 3, 1913, entitled "An act to reduce tariff duties and to provide revenue for the Government, and for other purposes" (38 Stat., 114), and the act of Congress approved February 2, 1903, entitled "An act to enable the Secretary of Agriculture to more effectually suppress and prevent the spread of contagious and infectious diseases of live stock, and for other purposes" (32 Stat., 791), the following regulations are issued for the purpose of preventing the introduction of anthrax, foot-and-mouth disease, and rinderpest from a foreign country into the United States.

REGULATION I.

HIDES AND SKINS.

SECTION 1. All hides of neat cattle, calfskins, buffalo hides, sheepskins, goat-skins, and deerskins offered for entry into the United States from any foreign country (except abattoir and hard, sun-dried hides and skins as hereinafter provided) must be accompanied by a certificate signed by the United States consular officer of the district from which such hides or skins are shipped or by a certificate issued by the chief of the veterinary service or the duly authorized sanitary inspector of the country from which such hides or skins are shipped, authenticated by the said United States consular officer, stating that anthrax is not prevalent, and that neither foot-and-mouth disease nor rinderpest exists in such district, or by a certificate signed by the said consular officer showing that such hides or skins have been disinfected by immersion for not less than 24 hours in a 1 to 1,000 bichloride of mercury solution.

SEC. 2. If such hides or skins (other than abattoir and hard, sun-dried hides and skins) offered for entry into the United States are certified, as required by section 1, to be from a district where anthrax is not prevalent, but in which either foot-and-mouth disease or rinderpest exists, they will be admitted if certified by the United States consular officer of the district from which shipped to have been disinfected by immersion for not less than 30 minutes either in a 1 to 1,000 bichloride of mercury solution or in a 5 per cent solution of carbolic acid.

SEC. 3. Such hides or skins (other than abattoir and hard, sun-dried hides and skins), if packed in bales the exterior surface of each of which is thoroughly whitewashed under consular supervision prior to shipment, may be imported without previous disinfection upon the conditions that they will be disinfected at the owner's expense after arrival at destination in the United States; that the destination is a tannery having proper facilities for disinfecting the same; that they will move from the port of entry only under customs seal; and that they will be disinfected at destination under the supervision of the Bureau of Animal Industry (a) when certified as required by section 1 to be from a district where anthrax is not prevalent by immersion in a 5 per cent solution of carbolic acid or a 2 per cent solution of chloride of lime or a 1 to 5,000 solution of bichloride of mercury, with not less than 24 hours' exposure; or (b) when not certified in any of the forms aforesaid by immersion in a 1 to 1,000 bichloride of mercury solution with not less than 48 hours' exposure, or in a 1 to 5,000 bichloride of mercury solution with not less than 6 days' exposure plus not less than 5 days in lime of the usual strength for dehairing.

SEC. 4. Hard, sun-dried hides and skins may be imported without disinfection if certified as required in section 1 to be from a district or districts where anthrax is not prevalent, if each bale or hide is distinctly marked for identification, each shipment showing invoice number, names, and addresses of consignees and consignor as such hard sun-dried hides and skins so certified showing freedom from anthrax can be considered as having been disinfected by the process of curing and need not be submitted to any further treatment, or such hides or skins may be imported without being certified to be from a district where anthrax is not prevalent if accompanied by a consular certificate showing them to have been disinfected prior to shipment by immersion for not less than 24 hours in a 1 to 1,000 bichloride of mercury solution, or such hides and skins may be imported without any certification upon the conditions prescribed in section 3 for importations to be disinfected at destination in the United States by immersion in a 1 to 1,000 bichloride of mercury solution with not less than 48 hours' exposure, or in a 1 to 5,000 bichloride of mercury solution with not less than 6 days' exposure plus not less than 5 days in lime of the usual strength for dehairing.

REGULATION II.

ABATTOIR HIDES AND SKINS.

Abattoir hides and skins taken from animals slaughtered in Sweden, Norway, Australia, New Zealand, Great Britain, Uruguay, and Argentina, when accompanied by a certificate of an official veterinarian of the country where such animals were slaughtered, showing that such hides or skins were taken from animals free from disease at the time of slaughter, may be imported into the United States without disinfection.

REGULATION III.

GLUE STOCK.

Fleshings, hide cuttings and parings, or glue stock shall be subject to disinfection and certification under the requirements of these regulations the same as hides and skins, except that such fleshings, hide cuttings and parings, or glue stock may be imported without disinfection if shown by a consular invoice used upon entry or by a consular certificate to have been sterilized by heat (not less than 200° F.) or by acidulation, or to have been lime dried after

soaking for not less than 7 days in a strong lime wash made by slaking quicklime in water in such proportion as to be of a creamy consistency, or to have been dried by exposure to the action of the sun and air for a sufficient time to render each piece of the hardness of a sun-dried hide, provided the consignee or his agent files a satisfactory bond or agreement that said materials and containers will be handled or sterilized in a manner acceptable to the Bureau of Animal Industry before distribution from the factory or establishment to which consigned.

REGULATION IV.

BONES, HOOFS, AND HORNS.

SECTION 1. Bones, hoofs, and horns which are clean, dry, and free from pieces of hide, flesh, or sinews may be imported without restrictions other than a satisfactory agreement on the part of the consignee or his agent to destroy or sterilize the bags or containers thereof at destination.

SEC. 2. Bones, hoofs, and horns with pieces of hides or tendons attached and also horn piths either will be subject to the requirements of Regulation III or may be forwarded to a factory or other establishment in sealed cars after the bags or containers have been sprayed with lime wash under the supervision of an inspector of the Bureau of Animal Industry, provided the consignee or his agent files a satisfactory bond or agreement that such materials will be sterilized in an acceptable manner before distribution from the factory or other establishment to which shipped, and that the bags or containers thereof will be sterilized or destroyed.

REGULATION V.

WOOL AND HAIR.

SECTION 1. Clipped wool may be imported in bales if accompanied by an affidavit of a competent authority of the district from which the wool is shipped, authenticated by the United States consul at the port of shipment, designating the bales by their markings, indicating the consignor, consignee, and number of the invoice, and stating that all the wool contained in such bales was clipped from live animals free from foot-and-mouth disease, rinderpest, and anthrax, and that the same has not been exposed to the infection of these diseases.

SEC. 2. Picked or pulled wool or hair may be imported if accompanied by a declaration of the exporter, authenticated by the United States consul at the port of shipment, to the effect that such wool or hair, designated in the manner provided in section 1 of this regulation for clipped wool, came from animals free from anthrax. The consignee or owner of such wool or hair or his agent shall be required to file a satisfactory bond or agreement assuring proper facilities of disinfection at the establishment to which the shipment is consigned, and that all of such wool or hair will be disinfected or sterilized by proper exposure to a temperature of not less than 200° F. prior to any transfer or reshipment from such establishment. If such wool or hair, when offered for entry, is unaccompanied by the above-mentioned declaration, its entry will be permitted upon the condition that the consignee or owner thereof or his agent files a satisfactory bond or agreement assuring proper facilities for disinfection at the establishment to which the shipment is consigned, and that all of such wool or hair will be disinfected or sterilized by proper exposure to a temperature of not less than 212° F. for at least 15 minutes prior to any transfer or reshipment from such establishment.

SEC. 3. Importation of abattoir pulled wool will be permitted without restrictions from any country maintaining a veterinary inspection system ascertained by the Secretary of Agriculture and certified by him to the Secretary of the Treasury, from time to time, to be the substantial equivalent of the veterinary inspection system maintained by the United States, when accompanied by a certificate signed by an official veterinary inspector of such country to the effect that said wool was procured from sheep slaughtered therein under Government inspection, and that in the process of wet pulling and drying it has been subjected to a temperature of not less than 200° F. Such certificate must indicate the number of bales, marks, names, and addresses of consignor and consignee, district of origin, date of shipment, invoice number, and vessel transporting.

SEC. 4. All wool and hair unaccompanied by certificates, affidavits, and declarations herein provided, when permitted to be entered without such certificates, affidavits, and declarations, must be shipped from port of entry to destination in sealed cars after the bales or bundles have been whitewashed at such port of entry under the supervision of an inspector of the Bureau of Animal Industry, and the destination of such wool or hair must be a factory or establishment having satisfactory facilities for sterilizing or disinfecting the same in the manner provided by these regulations or as may be directed by the Chief of the Bureau of Animal Industry. The consignee, owner, or his agent will be required to file a satisfactory bond or agreement to fulfill all requirements as to shipment and disinfection or sterilization.

REGULATION VI.

HAY, STRAW, ETC., AND MEATS PACKED IN HAY OR STRAW.

SECTION 1. On account of the existence of foot-and-mouth disease in the countries of continental Europe and South America, and the impracticability of disinfecting hay and straw used as the packing on meats offered for entry without injuring the meats for food purposes, the entry into the United States from any of those countries of any meats packed in hay or straw is prohibited.

SEC. 2. Bran, middlings, and mill feed may be imported from Argentina without being disinfected as prescribed in section 4 if accompanied by a certificate signed by the United States consul of the district from which shipped showing that such bran, middlings, or mill feed was conveyed by chutes directly from the mill in which produced into the vessels transporting the same to the United States.

SEC. 3. Because of lack of danger of the communication of disease through the importation of hay, straw, forage, and similar materials, including bran, middlings, or other mill feed originating in and transported directly from Great Britain, Ireland, the Channel Islands, Canada, and Mexico, such articles may be imported into the United States from these countries as long as the above condition continues to exist without being disinfected as prescribed in section 4.

SEC. 4. Except as otherwise provided in this regulation all hay, straw, forage, or similar materials, including bran, middlings, or other mill feed, offered for importation from any foreign country shall be disinfected in the manner prescribed by the Chief of the Bureau of Animal Industry, at the expense of the owner, before being unloaded from the vessel or conveyance bringing the same into any port of the United States, and when unloaded and landed shall be stored and held in quarantine for a period of not less than three months

at some place acceptable to the Chief of the Bureau of Animal Industry and under directions prescribed by him.

REGULATION VII.

CANADA.

Because of the lack of danger of the introduction of disease into the United States through the importation of the articles enumerated in these regulations originating in and transported directly from Canada, such articles may be imported from Canada as long as the above condition continues to exist without being disinfected or certified as prescribed by these regulations.

REGULATION VIII.

PRODUCTS FROM DISEASED ANIMALS.

Importation into the United States of any hides, skins, fleshings, hide cuttings, parings, and glue stock, hair, wool, or other animal products covered by these regulations, taken or removed from animals affected with anthrax, foot-and-mouth disease, or rinderpest, is prohibited.

REGULATION IX.

DISINFECTION OF CARS, BOATS, OTHER VEHICLES, AND PREMISES.

Cars, boats, other vehicles, yards, and premises which have been used in the transportation, handling, and storing of uncertified or nondisinfected imported hides, skins, and parts thereof, hair, wool, and other animal by-products, hay, straw, forage, or similar material, permitted entry subject to disinfection, shall be cleaned and disinfected, under the supervision of the Bureau of Animal Industry, subject to the conditions and in accordance with the requirements of the regulations of the United States Department of Agriculture contained in B. A. I. Order 245, governing the disinfection of cars, boats, other vehicles, yards, and premises used in interstate movement of live stock, except that all such cars, boats, other vehicles, yards, and premises, storage places used in the transportation, handling, and storing of any of said articles uncertified for nonprevalence of anthrax, or which have not been disinfected against anthrax, shall be disinfected with a 1 to 1,000 bichloride of mercury solution. The permitted disinfectants specified in the said B. A. I. Order 245 may be used in disinfection against the other communicable diseases.

PRIOR ORDERS ANNULLED.

Treasury Department Circular No. 23, dated May 2, 1910, and all amendments thereto, and B. A. I. Order 129, dated October 4, 1904, and all amendments thereto, shall cease to be effective on and after January 1, 1917, on and after which date this order, which for purposes of identification is designated as United States Treasury Department and Department of Agriculture Joint Order No. 1, shall become and be effective until otherwise ordered.

(Signed) WM. P. MALBURN,
Acting Secretary of the Treasury.
D. F. HOUSTON,
Secretary of Agriculture.

**MASSACHUSETTS: RULES AND REGULATIONS SUGGESTED FOR
THE PREVENTION OF ANTHRAX, 1916.¹**

PREAMBLE.

Anthrax may be transmitted to man by infected hides, skins, wool, horse hair, cow hair, goat hair, pigs' bristles or pigs' wool, as well as by dried blood, bones, and other animal products. The bacillus of anthrax soon dies out when dried at the ordinary temperature, but the spores of the disease may remain active, under favorable circumstances, for many years. These spores, inclosed in blood clots, dried and caked on the hair, skin, or wool, are the usual sources of infection, owing to the clots breaking up into dust. The dust arising in the handling, sorting, and manipulation of the animal products readily finds its way into the lungs in breathing, or is swallowed in the act of eating or drinking. More often, however, the dust finds its way into broken skin by cuts, bruises, or scratched pimples. The result of this infection is anthrax. Anthrax, therefore, is chiefly a dust disease. (It can be caused by eating diseased meat and by the bite of an insect which has fed upon infected carcasses or other material.) While the danger of anthrax is greatest, according to all statistics, in the manipulation of animal products imported from China, Russia, and Siberia, nevertheless the disease is so widely distributed that in no country is it unknown. Consequently, the precautions which are most necessary where hides, skins, hair, and wool from the countries named are handled can, with advantage, be applied to products from other countries. In the United States there is no interstate quarantine law nor disinfection regulation against anthrax.

Protection against anthrax can be grouped under these headings, viz.:

1. Disinfection of the material.
2. The avoidance of dust.
3. The instruction of the workers.

The experience of countries where anthrax has been more prevalent than it has been in this country shows (1) that wool or hair can be readily disinfected by steam without injury to the material, and (2) that hides and skins can be disinfected without damage to these articles and without injury to subsequent manufacturing processes.

The following rules and regulations shall apply to all establishments where hides, skins, fur, horse hair, bristles, wool, horns, bones, or other animal products liable to be infected with anthrax are handled.

For the enforcement of these rules and regulations all products or parts of animals shall be considered in a raw state unless they have undergone a treatment as follows:

Hides and skins—tanning.

Wool—scouring.

Horse hair, fur, and hog bristles—bleaching.

Horns and bone—boiling for two hours, or treatment with a strong antiseptic.

The following industries shall be considered dangerous within these rules and regulations, and they shall apply in a special manner in those departments where these processes are carried on, viz.:

1. The unpacking, unloading, or other handling, when dry, or before disinfection of the material.
2. The preparation of horse hair.
3. Tawing, tanning, and fur dressing.
4. The pulling, scouring, and sorting of wool.

¹ Massachusetts Board of Labor and Industries, Industrial Bulletin No. 6.

DISINFECTION.

All foreign¹ hides, skins, horse hair, cow hair or goat hair, pigs' bristle, and pigs' wool, before they are manipulated in any factory or establishment in this State, shall be disinfected (unless exempted as hereinafter provided) at the choice of the manufacturer in one of the following prescribed ways:

A. Hides and Skins.

(1) By the Seymour-Jones method, viz: To 1 pound of perchloride of mercury add 500 gallons of water, and to this mixture add 5 gallons of formic acid (commercial 50 per cent strength). In this bath steep the material for 24 hours; or,

(2) By the Schattenfroh method, viz: In a 2 per cent hydrochloric acid solution to which 10 per cent of common salt has been added, steep the material for a few days. A quicker method can be used by substituting a 1 per cent solution of hydrochloric acid and 8 per cent of salt, provided the temperature of the solution is maintained at 40° C. (104° F.) for a period of six hours.

B. Hair, Bristles, and Pigs' Wool.

(1) By letting a current of steam act on the material for not less than one-half hour at a pressure of 17 pounds (0.15 above atmospheric pressure); or,

(2) By boiling for at least one-quarter of an hour in a solution containing 2 per cent of permanganate of potassium, and subsequent bleaching with a 3 or 4 per cent solution of sulphurous acid; or,

(3) By boiling in water for not less than two hours.

Exemptions.

The disinfection by the manufacturer may be dispensed with if he presents proof in writing stating that the material has been disinfected in accordance with the requirements of the United States Treasury Department or of the Massachusetts State Department of Health.

The manufacturer shall not be required to disinfect white bristles which he subjects to a subsequent bleaching process before further manipulation, or which he has bought already bleached (so-called French bristles) and which have been kept apart from nondisinfected material.

Exemption from the requirements of section B may be authorized by the State Board of Labor and Industries for those materials that, according to present experience, would be seriously damaged, or for those materials that can be certified to as having already undergone an equally effective disinfection in the country or State from which they have been exported.

Prior to disinfection prescribed by these rules and regulations only such steps as are indispensable to the examination of the quality of the material, to the prevention of their being spoiled, and to the preparation and the execution of the disinfection are permitted in relation to material required to be disinfected, e. g., unpacking and preparing for disinfection.

The stock of nondisinfected materials which are required to be disinfected, or which are exempted from disinfection, shall be stored in separate rooms and kept apart from the stock that has been disinfected. Access to this room should be restricted as much as possible so as to avoid unnecessary exposure of workmen.

Records.

The employer shall keep a record of the skins, hides, hair, bristles, wool, and other material mentioned in these rules and regulations, in such a manner that the quantity, the source of supply, and, so far as is known, the origin of the merchandise received, as well as the time and the method of disinfection, or the

¹ Also domestic whenever anthrax is prevalent in the locality from which the material has been exported.

reason for its omission, are clearly set forth. Such records shall be accessible to the State Board of Labor and Industries or its representatives.

SANITATION OF WORKSHOPS.

Floors.—In those parts of the establishment where material capable of transmitting anthrax is stored or manufactured the floors shall have a waterproof covering or other suitable material that permits the ready washing of such floors. The floors of these departments should be washed daily if the workroom is dusty or if cases of anthrax have occurred recently at the establishment.

Walls and ceiling.—The walls and ceiling of such workshop or room, unless covered with a smooth washable coating or oil painting, should be washed frequently with a disinfectant solution. If whitewash is used this coating should be renewed on the outbreak of cases of anthrax among workmen employed in that establishment.

Tables, workbenches and seats.—These articles should be washed twice a week with a disinfectant solution, especially if cases of anthrax have occurred recently in the establishment.

Ventilation.—The workroom shall be well aired twice daily by means of open windows, for at least half an hour, viz, during noonday meal hour and after the day's work has been finished, or before it has begun again. No workman should be permitted to remain in the room during this period.

Dust removal.—In all workrooms in which dust is a factor there shall be an adequate exhaust system installed capable of removing the dust at its origin and conveying it to a suitable receptacle for subsequent destruction.

It is recommended that hides and skins be submitted to the ordinary "wet salting" process immediately after flaying; or if cured by drying, that the hides and skins be converted back to the "wet salted" state by the formic-mercury processes as soon as possible.

In horsehair factories and horsehair dressing, the sorting and hackling shall not be done except in special workrooms separate from the other workroom. The dust created shall be collected and destroyed.

Carding and dust-extracting machinery as well as mixing, willowing, and hackling machines, shall be closed over and provided with an adequate and effective dust exhaust system. The dust shall be collected in a dust chamber and burned.

The treatment of wool, horsehair, hog bristles, and furs shall take place whenever possible in closed vessels. In those operations, such as opening of bales or beating, which can not take place in closed vessels, the process shall be carried on in such a way as to allow the collecting of the refuse and its subsequent destruction.

PERSONAL PRECAUTIONS.

Printed notices issued by the State Board of Labor and Industries shall be kept posted in a conspicuous place in each department, setting forth the dangers of anthrax infection, the early signs and symptoms of the disease, and the precautions that shall be taken in order to avoid this infection.

Any employee who is suffering from a cut, scratch, pimple, or crack of the skin that has not healed readily shall report the same to the person in charge or to factory physician.

Employers shall furnish to employees impermeable aprons and leggings (or rubber boots) in all operations where the body is liable to come in contact with the water used in tanning, scouring, boiling, or bleaching of animal product.

Employees shall wear a suitable respirator (loose gauze cloth tied over nose and mouth may be used) while engaged in the dusty processes of handling, sorting, or of manufacture.

Employers shall provide for the use of employees overalls and gloves when handling raw material, and neck protectors when carrying raw material on the shoulder. Raw material shall be transported on carts or handbarrows whenever practicable.

Employers shall see that the materials provided for the use of employees are worn by the persons for whom they are intended, and that when these articles are not in use they are kept in a special place, and that they are disinfected at least once a week.

Dressing rooms, wash rooms, and a suitable dining room shall be provided and fitted up outside the place where dangerous operations are carried on.

There shall be provided an adequate supply of running hot and cold water, toilets, washing and drinking facilities, all in accordance with the rules of the State Board of Labor and Industries on toilets. Lockers shall be provided so that street clothes and work clothes may be kept separate and apart.

Employees shall not bring food into the workroom. The eating of food in workroom shall be strictly prohibited.

Employees shall be required to take off their work clothes before entering the dining room, and to wash hands, arms, neck, and face before taking their meals or leaving the premises.

Employers shall keep posted in a conspicuous place in each department a notice legible to all employees stating—

1. The text of these rules and regulations.

2. Workshop regulations imposing on employees the following obligations:

- (a) To make use of the various working clothes and other articles provided for them by the employer.

- (b) To make use of the dressing room and washing facilities.

- (c) To take the necessary measures for cleanliness before eating and before leaving the workshop.

- (d) To bring no food into the workroom.

3. The dangers of anthrax infection, and the precautions that should be taken to avoid them, and the necessity of employees reporting at once all skin affections.

4. Name and address of physician in charge of the medical service of the establishment.

Note.

The first symptom of anthrax is usually a small inflamed swelling like a pimple or boil. This is often painless. In a few days the pimple becomes black at the center and is surrounded by other "pimples." The poison is now liable to be absorbed into the system and will cause risk of life if not removed by prompt and effective treatment. Early treatment is usually successful; delay or neglect usually leads to blood poisoning, often to death.

**NEW YORK: STATE INDUSTRIAL COMMISSION, DIVISION OF
INDUSTRIAL HYGIENE, RECOMMENDATIONS, 1916.**

I. Every physician should report at once to the State industrial commission every case of anthrax coming under his care.

II. In every establishment where articles liable to be infected with anthrax are handled a competent physician should be employed.

III. In every such establishment the employer should make such special provision for the protection of his employees as the commission shall determine.

IV. Every employee should be required to make use of the means provided for his safety by the employer.

V. It should be the duty of the shop foreman or superintendent to enforce the use by the employees of the means provided by the employer.

VI. Attention of physicians and of the public should be called to the dangers of anthrax.

VII. Cooperation with Federal and contiguous State authorities should be maintained to prevent the entrance of infected materials into commerce.

THE PHYSICIAN.

1. He should visit the establishment every day and sign a register showing the time of his visit, this register to be subject to inspection by the State industrial commission.

2. He should examine every workman at entrance upon employment, and as often thereafter as necessary. He should instruct new employees individually, and the others frequently in classes, in methods of preventing anthrax.

3. He should be provided with facilities for the prompt diagnosis and early treatment of anthrax. He should have charge of the first-aid kits, as approved by the commission. He should instruct foremen and others selected in the use of first aid.

4. He should keep a record of all examinations and of all treatments, such record to be subject to inspection by the commission. He should report promptly to the commission every case of anthrax, together with a record of the source of the infecting material.

THE EMPLOYER.

1. In factories the floors should be of cement or waterproofed easily washed material. The walls should be whitewashed. When a case of anthrax develops the floors should be thoroughly cleaned and the walls whitewashed. Tables, work benches, and other articles coming in contact with materials should be washed as often as necessary with a disinfecting solution.

2. Dressing rooms, wash rooms, and lunch rooms should be provided, separate from the work rooms. The dressing room should be so arranged that the working clothes may be kept separate from the street clothes. The wash rooms should be provided with basins, water, soap, individual towels, etc., as directed by the industrial code. No food should be allowed in the workrooms.

3. Where dust is evolved in the process special ventilating apparatus should be installed according to the judgment of the commission.

4. To avoid, as much as possible, contact with materials, suitable clothing, waterproof aprons, overalls, shoes, gloves, etc., should be provided the workmen.

5. Notices in different languages should be posted conspicuously throughout the workrooms:

(a) Requiring the use of protective clothing; requiring the use of dressing rooms and wash rooms; forbidding food in workrooms.

(b) Warning of dangers of anthrax; instructing as to methods of avoiding it; requiring the report to foremen of even slight accidents or injuries.

6. The foreman or superintendent should be held responsible for observance of the regulations.

THE EMPLOYEE.

1. He should realize the danger of anthrax and the necessity of avoiding infection.

2. He should wear the clothing and use the dressing rooms, wash rooms, and lunch rooms provided by the employer. No food should be taken into the workrooms.

3. He should report at once to the foreman even slight injuries and should follow strictly directions of the physician.

4. He should assist the foreman in enforcing the regulations.

APPENDIX B.—TEXT OF EUROPEAN REGULATIONS.¹

GREAT BRITAIN: REGULATIONS FOR HANDLING DRY AND DRY-SALTED HIDES AND SKINS IMPORTED FROM CHINA OR FROM THE WEST COAST OF INDIA, 1901.

DUTIES OF OCCUPIER.

1. Proper provisions to the reasonable satisfaction of the inspector in charge of the district shall be made for the keeping of the workmen's food and clothing outside any room or shed in which any of the above-described hides or skins are unpacked, sorted, packed, or stored.

2. Proper and sufficient appliances for washing, comprising soap, basins, with water laid on, nailbrushes and towels, shall be provided and maintained for the use of the workmen, to the reasonable satisfaction of the inspector in charge of the district.

3. Sticking plaster and other requisites for treating scratches and slight wounds shall be kept at hand, available for the use of the persons employed.

4. A copy of the appended notes shall be kept affixed with the rules.

DUTIES OF PERSONS EMPLOYED.

5. No workman shall keep any food, or any articles of clothing other than those he is wearing, in any room or shed in which any of the above-described hides or skins are handled. He shall not take any food in any such room or shed.

6. Every workman having any open cut or scratch or raw surface, however trifling, upon his face, head, neck, arm, or hand shall immediately report the fact to the foreman, and shall not work on the premises until the wound is healed or is completely covered by a proper dressing after being thoroughly washed.

NOTE 1. [States that these rules must be kept posted in conspicuous places in the factory, workshop, or other premises to which they apply, where they may be conveniently read by the persons employed. Any person who is bound to observe them and fails to do so, or acts in contravention of them, is liable to a penalty; and in such cases the occupier is also liable to a penalty unless he proves that he has taken all reasonable means, by publishing and, to the best of his power, enforcing them, to prevent the contravention or noncompliance. A printed copy must be supplied by the occupier to any person affected by them if such person applies for it. Pulling down, injuring, or defacing any copy so posted is punished by a fine not exceeding £5 (\$24.33).]

NOTE 2. [Is an earlier and less complete form of the note shown on page 140.]

NOTE 3.—Suitable overalls, protecting the neck and arms, as well as ordinary clothing, add materially to the safety of the workmen, and should be provided and worn, where practicable, if dangerous hides are handled. They should be discarded on cessation of work. Similarly, for the protection of the hands, gloves should be provided and worn where the character of the work permits.

¹ From monthly bulletin of the International Labor Office.

GREAT BRITAIN: SORTING, WILLEYING [WILLOWING], WASHING, COMBING, AND CARDING WOOL, GOAT HAIR, AND CAMEL HAIR, AND PROCESSES INCIDENTAL THERETO, 1905.

DEFINITION.

For the purpose of regulations 2, 3 and 18, opening of wool or hair means the opening of the fleece, including the untying or cutting of the knots, or, if the material is not in the fleece, the opening out for looking over or classing purposes.

DUTIES OF OCCUPIERS.

1. No bale of wool or hair of the kinds named in the schedules shall be opened for the purpose of being sorted or manufactured, except by men skilled in judging the condition of the material.

No bale of wool or hair of the kinds named in schedule A shall be opened except after thorough steeping in water.

2. No wool or hair of the kinds named in schedule B shall be opened except (a) after steeping in water, or (b) over an efficient opening screen, with mechanical exhaust draft, in a room set apart for the purpose, in which no other work than opening is carried on.

For the purpose of this regulation, no opening screen shall be deemed to be efficient unless it complies with the following conditions:

(a) The area of the screen shall, in the case of existing screens, be not less than 11 square feet, and in the case of screens hereafter erected be not less than 12 square feet, nor shall its length or breadth be less than $3\frac{1}{2}$ feet.

(b) At no point of the screen within 18 inches from the center shall the velocity of the exhaust draft be less than 100 linear feet per minute.

3. All damaged wool or hair or fallen fleeces or skin, wool or hair, if of the kinds named in the schedules, shall, when opened, be damped with a disinfectant and washed without being willowed.

4. No wool or hair of the kinds named in schedules B or C shall be sorted except over an efficient sorting board, with mechanical exhaust draft, and in a room set apart for the purpose, in which no work is carried on other than sorting and the packing of the wool or hair sorted therein.

No wool or hair of the kinds numbered (1) and (2) in schedule A shall be sorted except in the damp state and after being washed.

No damaged wool or hair of the kinds named in the schedules shall be sorted except after being washed.

For the purpose of this regulation, no sorting board shall be deemed to be efficient unless it complies with the following conditions:

The sorting board shall comprise a screen of open wirework, and beneath it at all parts a clear space not less than 3 inches in depth. Below the center of the screen there shall be a funnel, measuring not less than 10 inches across the top, leading to an extraction shaft, and the arrangements shall be such that all dust falling through the screen and not carried away by the exhaust can be swept directly into the funnel. The draft shall be maintained in constant efficiency while the sorters are at work, and shall be such that not less than 75 cubic feet of air per minute are drawn by the fan from beneath each sorting board.

5. No wool or hair of the kinds named in the schedules shall be willowed except in an efficient willowing machine, in a room set apart for the purpose, in which no work other than willowing is carried on.

For the purpose of this regulation, no willowing machine shall be deemed to be efficient unless it is provided with mechanical exhaust draft so arranged as to draw the dust away from the workmen and prevent it from entering the air of the room.

6. No bale of wool or hair shall be stored in a sorting room; nor any wool or hair except in a space effectually screened off from the sorting room.

No wool or hair shall be stored in a willowing room.

7. In each sorting room, and exclusive of any portion screened off, there shall be allowed an air space of at least 1,000 cubic feet for each person employed therein.

8. In each room in which sorting, willowing, or combing is carried on, suitable inlets from the open air or other suitable source shall be provided and arranged in such a way that no person employed shall be exposed to a direct draft from any air inlet or to any draft at a temperature of less than 50° F.

The temperature of the room shall not, during working hours, fall below 50° F.

9. All bags in which wool or hair of the kinds named in the schedules has been imported shall be picked clean and not brushed.

10. All pieces of skin, scab, and clippings or shearings shall be removed daily from the sorting room and shall be disinfected or destroyed.

11. The dust carried by the exhaust draft from opening screens, sorting boards, willowing or other dust-extracting machines and shafts shall be discharged into properly constructed receptacles and not into the open air.

Each extracting shaft and the space beneath the sorting boards and opening screens shall be cleaned out at least once in every week.

The dust collected as above, together with the sweepings from the opening, sorting, and willowing rooms, shall be removed at least twice a week and burned.

The occupier shall provide and maintain suitable overalls and respirators, to be worn by the persons engaged in collecting and removing the dust.

Such overalls shall not be taken out of the works or warehouse, either for washing, repairs, or any other purpose, unless they have been steeped overnight in boiling water or a disinfectant.

12. The floor of every room in which opening, sorting, or willowing is carried on shall be thoroughly sprinkled daily with a disinfectant solution after work has ceased for the day, and shall be swept immediately after sprinkling.

13. The walls and ceilings of every room in which opening, sorting, or willowing is carried on shall be limewashed at least once a year and cleansed at least once within every six months, to date from the time when they were last cleansed.

14. The following requirements shall apply to every room in which unwashed wool or hair of the kinds named in the schedules, after being opened for sorting, manufacturing, or washing purposes, is handled or stored:

(a) Sufficient and suitable washing accommodation shall be provided outside the rooms and maintained for the use of all persons employed in such rooms. The washing conveniences shall comprise soap, nailbrushes, towels, and at least one basin for every five persons employed as above, each basin being fitted with a waste pipe and having a constant supply of water laid on.

(b) Suitable places shall be provided outside the rooms in which persons employed in such rooms can deposit food, and clothing put off during working hours.

(c) No person shall be allowed to prepare or partake of food in any such room. Suitable and sufficient meal-room accommodation shall be provided for workers employed in such rooms.

(d) No person having any open cut or sore shall be employed in any such room.

The requirements in paragraph (c) shall apply also to every room in which any wool or hair of the kinds named in the schedules is carded or stored.

15. Requisites for treating scratches and slight wounds shall be kept at hand.

16. The occupier shall allow any of H. M. inspectors of factories to take at any time, for the purpose of examination, sufficient samples of any wool or hair used on the premises.

DUTIES OF PERSONS EMPLOYED.

17. No bale of wool or hair of the kinds named in the schedules shall be opened otherwise than as permitted by paragraph 1 of regulation 1, and no bale of wool or hair of the kinds named in schedule A shall be opened except after thorough steeping in water.

If on opening a bale any damaged wool or hair of the kinds named in the schedules is discovered, the person opening the bale shall immediately report the discovery to the foreman.

18. No wool or hair of the kinds named in schedule B shall be opened otherwise than as permitted by regulation 2.

19. No wool or hair of the kinds named in the schedules shall be sorted otherwise than as permitted by regulation 4.

20. No wool or hair of the kinds named in the schedules shall be willowed except as permitted by regulation 5.

21. Every person employed in a room in which unwashed wool or hair of the kinds named in the schedules is stored or handled shall observe the following requirements:

(a) He shall wash his hands before partaking of food or leaving the premises.

(b) He shall not deposit in any such room any article of clothing put off during working hours. He shall wear suitable overalls while at work and shall remove them before partaking of food or leaving the premises.

(c) If he has any open cut or sore, he shall report the fact at once to the foreman and shall not work in such a room.

No person employed in any such room or in any room in which wool or hair of the kinds named in the schedules is either carded or stored shall prepare or partake of any food therein or bring any food therein.

22. Persons engaged in collecting or removing dust shall wear the overalls as required by regulation 11.

Such overalls shall not be taken out of the works or warehouse, either for washing, repairs, or any other purpose, unless they have been steeped overnight in boiling water or a disinfectant.

23. If any fan, or any other appliance for the carrying out of these regulations, is out of order, any workman becoming aware of the defect shall immediately report the fact to the foreman.

SCHEDULE A.

(Wool or hair required to be steeped in the bale before being opened.)

1. Van mohair.

2. Persian locks.

3. Persian or so-called Persian (including Karadi and Bagdad), if not subjected to the process of sorting or willowing.

SCHEDULE B.

(Wool or hair required to be opened either after steeping or over an efficient opening screen.)

Alpaca.

Pelitan.

East Indian cashmere.

Russian camel hair.

Pekin camel hair.

Persian or so-called Persian (including Karadi and Bagdad), if subjected to the process of sorting or willowing.

SCHEDULE C.

(Wool or hair not needing to be opened over an opening screen, but required to be sorted over a board provided with downward draft.)

All mohair other than Van mohair.

Note.

The danger against which these regulations are directed is that of anthrax—a fatal disease affecting certain animals, which may be conveyed from them to man by the handling of wools or hairs from animals which have died of the disease. The germs of the disease (anthrax spores) are found in the dust attaching to the wool or in the excrement, and in the substance of the pieces of skin, and may remain active for years. In this country and Australia anthrax is rare, consequently there is little danger in handling wools from the sheep of these two countries; but in China, Persia, Turkey, Russia, the East Indies, and in many other parts of the world, the disease is common, and infected fleeces or locks (which may not differ from others in appearance) are often shipped to Great Britain. Hence, in handling foreign dry wools and hair, the above regulations should be carefully observed. Greasy wools are comparatively free from dust, and therefore little risk is incurred in handling them. The disease is communicated to man sometimes by breathing or swallowing the dust from these wools or hair, and sometimes by the poison lodging in some point where the skin is broken, such as a fresh scratch or cut, or a scratched pimple, or even chapped hands. This happens more readily on the uncovered parts of the body, the hand, arm, face, and most frequently of all, on the neck, owing either to infected wool rubbing against the bare skin, or to dust from such wool alighting on the raw surface. But a raw surface covered by clothing is not free from risk, for dust lodging upon the clothes may sooner or later work its way to the skin beneath. Infection may also be brought about by rubbing or scratching a pimple with hand or nail carrying the anthrax poison. Use of the nailbrush, and frequent washing and bathing of the whole body, especially of the arms, neck, and head, will lessen the chance of contracting anthrax.

The first symptom of anthrax is usually a small inflamed swelling like a pimple or boil—often quite painless—which extends, and in a few days becomes black at the center and surrounded by other “pimples.” The poison is now liable to be absorbed into the system, and will cause risk of life, which can be avoided only by prompt and effective medical treatment in the early stage, while the poison is still confined to the pimple. Hence it is of the utmost importance that a doctor should be at once consulted if there is any suspicion of infection.

GREAT BRITAIN: REGULATIONS FOR THE PROCESSES INVOLVING THE USE OF HORSEHAIR FROM CHINA, SIBERIA, OR RUSSIA, IN EFFECT APRIL 1, 1908.¹

DEFINITIONS.

"Material" means tail or mane horsehair from China, Siberia, or Russia, whether in the raw state or partially or wholly prepared, notwithstanding that such preparation may have taken place in some country other than those named.

"Disinfection" means (a) exposure to steam at a temperature not less than 212° F. for at least half an hour of material so loosened, spread out, or exposed as to allow the steam to penetrate throughout; or (b) exposure of material to such disinfectant under such conditions of concentration and temperature of the disinfectant, and duration and manner of exposure of the material to it, and otherwise, as are certified to secure the destruction of anthrax spores in all parts of all horsehair subjected to the process: *Provided*, That such a certificate shall have no force unless and until (1) a copy of it has been submitted to the secretary of state, and (2) a copy of it is kept in the register required under regulation 1: *Provided further*, That any such certificate may at any time be disallowed by the secretary of state, either generally or with regard to a factory or workshop in which anthrax has occurred.

"Certified" means certified by the director of a bacteriological laboratory recognized by a corporation in the United Kingdom having power to grant diplomas registrable under the medical acts, 1858 to 1905.

It shall be the duty of the occupier to observe Part I of these regulations.

It shall be the duty of all persons employed to observe Part II of these regulations.

PART I.—DUTIES OF EMPLOYERS.

1. A register shall be kept containing the prescribed particulars² of the disinfection of all material.

2. Material which has not undergone disinfection shall not be stored except in a room set aside for the purpose, in which no other horsehair shall be placed.

3. Material which has not undergone disinfection shall not be opened from the bale or sorted except in a room set aside for the purpose, in which no other horsehair shall be placed; nor shall any such material be opened from the bale, except over or by the side of an efficient screen, or sorted except over an efficient screen.

For the purposes of this regulation no screen shall be deemed to be efficient unless it is provided with an exhaust draft so arranged that at every point of the screen within 18 inches of the center the velocity of the exhaust draft shall be at least 300 linear feet per minute.

4. No material shall be subjected to any manipulation other than opening or sorting until it has undergone disinfection.

5. Every willowing and dust-extracting machine shall be covered over and provided with efficient exhaust draft so arranged as to carry the dust away from the worker.

6. The dust from the opening and sorting screens, and from the willow or other dust-extracting machines, shall be discharged into furnaces or into chambers so constructed as to intercept the dust.

7. Each extracting shaft and the space beneath the opening and sorting screen shall be cleaned out at least once in every week.

¹ Great Britain, Home Office. Factory and Workshops Orders, London, 1909, p. 93.

² See appended schedule, p. 143.

8. All dust collected from the opening and sorting screens shall be burned.

9. There shall be provided and maintained for the use of persons employed on material which has not undergone disinfection—

(a) Suitable overalls and head coverings, which shall be collected at the end of every day's work, and washed or renewed at least once every week, and shall not be taken out of the works for any purpose whatever unless they have previously been boiled for 10 minutes or have undergone disinfection after last being used; and

(b) A suitable meal room, separate from any workroom, unless the works are closed during meal hours; and

(c) A suitable cloakroom for clothing put off during working hours; and a suitable place, separate from the cloakroom and meal room, for the storage of the overalls; and

(d) Requisites for treating scratches and slight wounds.

10. There shall be provided suitable respirators for the use of persons employed in work necessitated by regulations 6, 7, and 8. Each respirator shall bear the distinguishing mark of the worker to whom it is supplied, and the filtering material shall be renewed after each day on which it is used.

11. There shall be provided and maintained in a cleanly state and in good repair for the use of all persons employed on material which has not undergone disinfection, a lavatory, under cover, with a sufficient supply of clean towels, renewed daily, and of soap and nailbrushes, and with either—

(a) A trough with a smooth impervious surface, fitted with a waste pipe without plug, and of such length as to allow at least 2 feet for every five such persons, and having a constant supply of warm water from taps or jets above the trough at intervals of not more than 2 feet; or

(b) At least one lavatory basin for every five such persons, fitted with a waste pipe and plug or placed in a trough having a waste pipe, and having either a constant supply of hot and cold water or warm water laid on, or (if a constant supply of heated water be not reasonably practicable) a constant supply of cold water laid on and a supply of hot water always at hand when required for use by persons employed.

12. No person under 18 years of age shall be employed on material which has not undergone disinfection.

13. No persons employed on material which has not undergone disinfection shall be allowed—

(a) To work having any open cut or sore; or

(b) To introduce, keep, prepare, or partake of any food or drink, or tobacco, in any room in which such material is stored or manipulated.

14. A cautionary notice as to anthrax, in the prescribed form, shall be kept affixed with these regulations.

PART II.—DUTIES OF PERSONS EMPLOYED.

15. No person employed shall—

(a) Open, sort, or willow or otherwise manipulate any material except in accordance with the foregoing regulations.

(b) Introduce, keep, prepare, or partake of any food or drink, or tobacco, contrary to regulation 13 (b).

16. Every person employed on material which has not undergone disinfection shall—

(a) Wear the overall and head covering provided in pursuance of regulation 9 (a) while at work, and shall remove them before partaking of food or

leaving the premises, and shall deposit in the cloakroom provided in pursuance of regulation 9 (c) all clothing put off during working hours; and

(b) Wash the hands and clean the nails before partaking of food or leaving the premises; and

(c) Report any cut or sore to the foreman, and until it has been treated, abstain from work on any such material.

17. Every person employed shall wear the respirator provided in pursuance of regulation 10 while engaged in work necessitated by regulations 6, 7, and 8.

18. If the arrangement for disinfection, or any fan, or any other appliance for the carrying out of these regulations, appears to any workman to be out of order or defective, he shall immediately report it to the foreman.

SCHEDULE: PROCESSES INVOLVING THE USE OF HORSEHAIR, 1908.

By an order dated March 11, 1908, the particulars to be entered on the register under regulation 1 of the order as to use of horsehair are to be:

With regard to each consignment of such horsehair received in the factory or workshop—

1. Weight of material.
2. Date of receipt on the premises.
3. Country of origin.
4. Whether raw or partially or wholly prepared.
5. Method of disinfection.

And in the case of material disinfected on the premises—

6. Date of disinfection.

And in the case of material disinfected elsewhere than on the premises—

7. Name of person from whom the material was obtained.

FRANCE: DECREE RELATING TO SPECIAL HYGIENIC MEASURES FOR ESTABLISHMENTS WHERE THE WORKERS ARE EXPOSED TO ANTHRAX INFECTION, 1913.

1. In the establishments contemplated in section 65 of Book II of the Labor Code, where are handled in the raw state skins, fur, horsehair, hogs' bristles, wool, horns, bones, or other animal products liable to be infected with anthrax, the principals, directors or works managers shall be required, irrespective of the general measures prescribed by the decree of July 10, 1913,¹ to adopt the special measures of protection and hygiene mentioned in the following articles.

In regard to the application of the present decree, such product or animal remains as have not undergone the treatment mentioned below shall be considered as in the raw state:

Horsehair, hogs' hair and bristles: Stoving at 103° for one hour, or soaking for two hours in boiling water, or bleaching.

Skins: Tanning.

Wools: Industrial degreasing.

Bones and horns: Stoving at 103° for one hour or soaking for two hours in boiling water, or treatment with powerful antiseptics.

All other methods of disinfection which the minister of labor, after taking the opinion of the consultative committee for arts and manufactures, shall recognize as equivalent, may also be allowed.

¹ For text of this decree see Bulletin of the International Labor Office, Vol. IX, 1914, p. 63.

2. A physician appointed by the principal of the establishment shall carry out the following inspections and make the required reports; his remuneration shall be at the expense of the establishment.

As soon as it shall come to the knowledge of principals, directors, or works managers that a workman is suffering either from a form of pimple, cut, abrasion, or crack which has not healed up after three days' dressing in the factory, they shall have him at once examined by the physician, who shall prescribe the necessary treatment. The name and age of the worker and the work in which he was engaged, the origin of the materials recognized as liable to have caused the infection, as also the result of the medical examination, shall be entered in a special register.

Every establishment shall be provided with a "first-aid" box containing the remedies and materials for dressing, as prescribed by ministerial order. This box shall always be kept in good condition, and placed in an easily accessible place.

3. The principals of works, directors, or managers shall be required to provide the workers with impermeable aprons and legging overalls for all work in which the body is liable to come in contact with the water used in the treatment of the products of animal remains mentioned in section 1.

4. The following industries shall be considered as dangerous within the meaning of section 5 hereunder, where materials are treated which have come from districts indicated in an order of the minister of labor, after consultation with the minister of commerce and industry and the minister of agriculture.

- (1) The preparation of horsehair.
- (2) The plucking, washing, and sorting of wools.
- (3) Tawing, tanning, and furriery.
- (4) The sorting and working up of bones and horns.

The following operations shall also be regarded as dangerous within the meaning of the same section: The unpacking, manipulation, and other operations performed in a dry condition, before disinfection of the materials enumerated in section 1, which have come from the regions indicated in the order above referred to.

5. In those parts of the establishment specially devoted to the carrying on of the industries or to the performance of the dangerous operations defined under section 4, the following precautions shall be observed:

In the workrooms the flooring shall consist of an impermeable covering or of a sectional paving which can be easily washed. The walls shall have a coating which can be thoroughly washed, or shall be limewashed.

This limewash coating shall be renewed whenever necessary, and especially when a case of anthrax has occurred. The tables, benches, and seats, also the floors and walls, shall be washed as often as may be necessary with a disinfecting solution. The tools shall be subjected to frequent disinfection.

In the storehouses where the materials referred to in section 1 are kept, every space temporarily unoccupied shall be cleaned with a disinfectant.

In the case of wool, horsehair, hogs' hair and bristles, the handling shall be done wherever possible in closed vessels.

As regards the material referred to in the preceding paragraph, the operations which it is impossible to carry out in a closed vessel—such as the opening of bales and, if necessary, the beating—must be carried out under such conditions as will allow of the collection of all the offal and its subsequent destruction.

The dressing and washing rooms for the use of the workers shall be fitted up outside the places where dangerous operations are carried on.

The said dressing and washing rooms shall be fitted with a sufficient number of basins or taps, with an ample provision of water and soap and a towel for each worker, which latter shall be renewed at least once a week. They shall, moreover, be provided with wardrobes or boxes which can be closed by key or a padlock, and which are divided into two compartments, so that the outdoor clothes may be kept separate from the working clothes.

In default of a separate cupboard divided into two compartments, every worker shall have at his disposal two clothes pegs on opposite sides of the dressing room, for the purpose of receiving on one side his ordinary and on the other side his working clothes. The clothes pegs shall be separated by a space of at least 30 centimeters [11.8 inches].

The workers shall be provided with overalls for handling materials in the raw state. They shall also be provided with protections for the neck, for the transport of those materials which have to be carried on the shoulder. Unless impracticable, all raw materials shall be carried in carts or handbarrows.

6. The minister of labor, by order issued on the report of the industrial inspectors, and after consultation with the consultative committee of arts and manufactures, shall have power to grant to an establishment, for a fixed term, relief from the whole or a portion of the provisions of section 5 (paragraphs 5 and 6) if it is recognized that the application of these provisions is practically impossible, and that the health of the workers is insured under conditions at least equal to those which are fixed by the present decree.

7. The principals, directors, or works managers shall be required to affix in a conspicuous position of the working premises—

(1) The text of the present decree.

(2) Shop rules, imposing on the workers the following duties: That they shall use the various working clothes and other working articles placed gratuitously at their disposal; that they shall make use of the dressing room and the washstands referred to in section 5 (paragraphs 7, 8, and 9); make good use of the provisions for cleanliness whenever leaving the premises; and bring no food into the workroom.

(3) A notice pointing out the dangers of anthrax, as also the precautions to be taken to avoid them, and the necessity of the workers to make the declaration indicated in section 2.

(4) The name and address of the physician intrusted with the medical service of the establishment.

The terms of the notice mentioned in the present section under (2) shall be fixed by a ministerial order.

GERMANY: ORDER CONCERNING THE EQUIPMENT AND OPERATION OF HORSEHAIR SPINNING ESTABLISHMENTS, OF SHOPS WHERE OTHER ANIMAL HAIR AND BRISTLES ARE MANIPULATED, AND OF BRUSH FACTORIES, 1902.

GENERAL RULES.

1. The following rules apply to all establishments where horse, cattle, and goat hair and bristles or hair of hogs are manipulated or spun into curled hair, as well as to brush factories.

2. Imported animal hair and bristles must not be manipulated unless disinfected in the establishment where they are to be used.

Disinfection must be effected by one of the following methods:

(1) Exposing the materials for at least half an hour to a current of steam under a pressure of 0.15 over atmospheric pressure.

(2) Boiling the materials for at least a quarter of an hour in a 2 per cent solution of permanganate of potassium and then bleaching them in a 3 or 4 per cent solution of sulphurous acid.

(3) Boiling them for at least two hours in water.

Other processes of disinfection may be authorized by the imperial chancellor.

The higher administrative authorities may order that the disinfection provided in section 2, No. 1, be effected in a public disinfecting establishment if there is one in the place where the factory is situated or in its immediate vicinity.

3. The manufacturer may be permitted to dispense with disinfection if he can prove, in conformity with regulations to be issued by the central State authorities, that the materials had already been disinfected according to the above rules when he received them and that he has stored them separately from nondisinfected material.

The manufacturer may omit disinfection of white bristles provided that he bleaches them before they are being worked up or if he has received them bleached (so-called French dressed bristles) and stored them separately from other nondisinfected material.

4. The central administrative authorities may authorize exemptions from the rules in section 2 for materials which—

(1) According to previous experience can not be subjected to the disinfection prescribed in section 2 without being exposed to considerable injury.

(2) Are proved to have been subjected abroad to treatment which is considered equivalent to disinfection in conformity with the rules in force in the German Empire.

The central administrative authorities must keep a register of the cases and reasons for which exemptions are granted. It must also indicate in the cases mentioned in paragraph (2) of this section the kind of treatment to which the materials have been subjected abroad. A copy of this register must be submitted annually, not later than February 1, to the central authority of the State.

5. The materials for which disinfection is required must, before disinfection, be subjected only to operations required to ascertain their condition, to prevent them from deteriorating, or to prepare them for disinfection, such as unpacking, cutting the hair adhering to the tails, transporting to the disinfecting apparatus, tying of the bristles in bundles, etc. Sorting is allowed only so far as it is necessary for the separation of hair which has to be subjected to different processes of disinfection.

6. Juvenile workers must not be employed either in disinfecting processes, or on materials exempted from disinfection in conformity with section 4, paragraph (1), nor are they allowed to work in the processes specified in section 5.

7. The employer must see that workers who have skin sores, especially on the neck, face, and hands, are not employed in the processes specified in section 6.

8. The employer must keep a register in which he must enter the stock of hair and bristles received by him in such a way that the quantity of these materials, the seller and, if possible, also the place of origin, the time at which they were disinfected and the processes used, or the reason for which disinfection was omitted become evident.

If the disinfection took place in a public establishment, the certificates given on that occasion must be collected, preserved, and produced whenever required by the supervisory officers.

9. Supplies of nondisinfected materials which are subject to disinfection and those which are exempt from disinfection according to section 4, para-

graph (1), must be kept in special locked rooms and may be taken to these rooms or removed from them only by passages and staircases which are not used by workers occupied on disinfected or on domestic materials. Disinfected or domestic goods must not be transported through those passages and staircases.

The operations which must necessarily precede disinfection, disinfection itself, and the manipulation of materials exempted from disinfection in accordance with section 4, paragraph (1), must not take place in rooms where disinfected or domestic materials are kept or manipulated.

The places where disinfected materials or those exempted from disinfection according to section 4, paragraph (1), are kept or manipulated, the entrance ways to those rooms, also the passages and staircases through which the materials of this category are transported, must be kept constantly clean. In cleaning them care must be taken to make as little dust as possible. The sweepings from, and the wrappings in which the nondisinfected materials arrived, must be burned or disinfected (section 2, paragraph 2). These measures apply equally to dust generated by, and refuse resulting from, the working up of nondisinfected materials and to rubbish.

REGULATIONS FOR LARGE ESTABLISHMENTS.

10. In establishments regularly employing 10 or more workers, the floor of the workshop must be solid and tight and must allow an easy removal of dust by washing. Wooden floors must be smoothly planed and water-tight.

The walls and ceilings, unless they are covered with a hard glazed surface which allows washing or are oil painted, must be whitewashed at least once a year.

In the construction of new and the enlargement of existing establishments, measures must be taken that in new workrooms where operations generating considerable dust are to be carried out, the number of workers should be so calculated that each will have at least 15 cubic meters [530 cubic feet] air space.

11. Workrooms must be completely aired for at least half an hour twice a day, i. e., during the noon hour and after the close or before the beginning of work. During this time workers must not be allowed in the shops.

The floors of rooms where work generating dust is carried on must be cleaned at least once a day by washing. The work tables in these rooms must be washed at least twice a week.

12. In establishments where horsehair is spun or otherwise prepared the sorting and hackling must be done in special rooms separated from the others. The dust generated and the rubbish must be gathered and removed.

13. Mixing, cleaning, and hackling machines (beating and willowing machines) must be covered and provided with effective exhaust drafts. The dust must be collected in a special chamber, and if it comes from nondisinfected materials it must be burned.

14. The workers employed on the processes preliminary to disinfection or in disinfection itself or in the treatment of materials exempted from disinfection according to section 4, paragraph (1), must be provided at the employer's expense with working clothes and caps in sufficient number and of proper materials.

By issuing suitable regulations and providing supervision the employer must see to it that the work clothes are used only by those workers to whom they are assigned, and that during the time when they are not in use the work clothes are kept in places designated for that purpose and disinfected at least

once a week. The employer must give to the workers mentioned in the first paragraph of this section the opportunity of taking a warm bath at least twice a week.

15. In a part of the establishment, free from dust, a dressing and washing room shall be kept for the workers; also a lunch room if necessary. The lunch room must be separated from the dressing room. These rooms must be kept clean and free from dust, and during the cold season they must be heated. In the lavatory the workers must be supplied with a sufficient quantity of water, soap, and towels, and with an adequate number of places for keeping the clothes which are taken off before beginning work.

16. The employer must issue for the workers manipulating the materials mentioned in the first paragraph of section 2 the following rules:

(1) The workers must use the working clothes provided for them during those operations for which these clothes are assigned.

(2) The workers must not bring any food into the workshops. They must eat only outside of these places.

(3) The workers are not allowed to enter the lunch rooms, to eat, or leave the establishment, except after taking off the working clothes prescribed in the first paragraph of section 14 and carefully washing their faces, necks, hands, and eyes.

In rules which are issued it must be stipulated that workers who violate the above regulations in spite of repeated warnings will be discharged without notice before the expiration of their time.

If shop rules are issued for an establishment, the above regulations must be included.

17. Sections 1-16, legibly written or printed, must be posted in each workshop, dressing room, and lunch room.

PRUSSIA: ORDER RELATING TO THE PROPAGATION OF ANTHRAX THROUGH ANIMAL SKINS, 1902.

INSTRUCTIONS WITH REGARD TO THE DANGERS TO HEALTH INVOLVED IN THE MANIPULATION OF RAW FOREIGN SKINS.

Experience has shown that the traffic in raw skins and hides, especially those of foreign origin, involves danger to the health of human beings and animals. Researches have proved that some of the raw skins (especially deer and kipskins coming from America, East India, and China) were taken from anthrax-infected animals. The cause of the disease is contained in these skins and hides in the form of very resistant anthrax spores. The usual processes to which the skins are subjected, such as drying, or treatment with salt, salt-peter, or arsenic, do not destroy the spore. The dust which is generated during sorting, packing, and transportation, and also during the opening of the bales and becomes mixed with shed hair is the principal carrier of the disease. The particles of dust and the hair, to which the anthrax spores adhere, are deposited on the clothes and bodies of persons near by, and enter the mouth, nose, ears, etc. Even the smallest abrasion of the skin may be instrumental in producing infection. Danger lies in the manipulation of raw materials and in the evil habit of removing with the finger nails dry crusts on the skins. The persons employed on raw skins can carry infection to other places on their soiled clothes, hair, hands, etc.

It has also shown that anthrax may be produced by the pollution of fodder and straw with particles of dust and hair from imported raw skins by the use of tanbark refuse as bedding in stalls and passageways, and by the tending

of animals by persons handling raw foreign hides. Even the use of refuse from tanneries for the purpose of fertilizing pastures and fields, also the soaking of skins in rivers and similar waters, may lead to the propagation of anthrax.

A reliable and practical process of disinfection which does not injure the skins is not known. For the purpose of minimizing the danger of infection the following precautionary measures can be recommended, especially to persons regularly engaged in the handling of raw skins:

(1) Storage places for raw foreign hides should be situated in out of the way localities at considerable distance from dwellings and from stables. They must be carefully fenced so that animals can not enter them.

(2) Sheds, etc., for the storage of straw and fodder must not be used as storage places or workrooms for the preparation of raw hides.

(3) The generation of dust must be avoided as much as possible during the opening of the bales, also during sorting, piling, packing, and other manipulations of skins; when necessary the skins should be sprinkled with water.

(4) The places where raw foreign hides are stored or worked up must be carefully cleaned after they are used; they must be disinfected at proper intervals.

(5) Tanbark used in the tanning, the hair and other refuse from the tanneries, and other remains, the straw, rags, cords, etc., which were used in packing the raw foreign hides, as well as the sweepings, must be either burned or buried after disinfection.

(6) Persons having external wounds should not be allowed to manipulate raw foreign hides.

(7) Before leaving the work place persons occupied in handling raw foreign hides must carefully clean their faces, arms, hands, hair, and beard.

(8) The storerooms, work places, etc., must be cleaned only by wet processes.

(9) A solution of chloride of lime (one part chloride of lime and three parts water) or a mixture of sulphuric and carbolic acid (one part of sulphuric acid, two parts of crude carbolic acid, and four parts of water) are recommended as disinfectants. These disinfectants should be also used on sweepings and other refuse.

PRUSSIA: REGULATIONS FOR THE PROTECTION OF WORKERS AGAINST THE DANGERS OF ANTHRAX, 1910.

1. Raw sheep and goat skins, as well as dry imported raw skins, shall be stored in separate storerooms, capable of being locked, which are used for this purpose only, and are not in direct communication with living rooms, stables or rooms for storing fodder.

2. The storerooms shall be provided with floors made of cement, asphalt or other impervious material, the joints being perfectly tight. Premises which have already been in existence may be used for a further period not exceeding 10 years, should they be provided with floors of the nature referred to above.

The storerooms shall be cleaned at least once a week, by means of damp sawdust or damp tanbark, for instance. Storerooms shall be disinfected after they have been wholly or partially emptied, by washing them with a solution of 1 part fresh chloride of lime in 20 parts water, in conformity with the regulation that the whole of the storeroom shall be disinfected in this manner at least once a year, but walls and ceiling only in so far as they have come in contact with raw skins. The said whitewash shall not be removed for a space of 24 hours at least.

Refuse and valueless packing material (straw, bast, ropes, etc.) shall be burned.

3. Raw sheep and goat skins, as well as dried imported raw skins, shall be handled with special care. Above all, care must be taken not to subject the said skins to an unnecessary amount of shaking and not to throw them about.

For the transport of skins the use of special contrivances, such as wagons (trolleys), etc., is very strongly recommended.

Workers shall not be allowed to carry skins unless they have been provided with protective hoods, which cover the head, neck, and shoulders; while they must also be provided with a sufficient number of smocks of good quality when handling dried foreign skins.

The employer shall insure that, by means of suitable arrangements and proper supervision, smocks and protective hoods are worn only by those workers to whom they have been handed for use, and that they are disinfected at once after having been in use for one week. The said disinfection shall be effected as the employer may direct, either by steaming at a pressure of not less than 0.15 above atmospheric pressure, or by boiling for at least one hour.

4. Workers who come in contact with raw sheep or goat skins or dried imported raw skins shall have their attention drawn at the commencement of their employment to the dangers of anthrax, to which they may be exposed, and they shall be handed a copy of the regulations for the prevention of accidents, and likewise instructions in regard to anthrax. The said instructions shall further be posted up in the workrooms. The necessary number of copies of the same will be placed at the disposal of the employers by the association.

5. A part of the works, as far as possible free from dust and suitable for the purpose, shall be reserved for washing rooms and, where it is customary for workers to take their meals within the works, lunch rooms shall be provided. The said lunch rooms shall be kept clean and free from dust, and shall be heated during the cold season.

6. The employer shall also insure that any worker who exhibits symptoms of anthrax shall immediately place himself under medical treatment, and, further, that any workers suffering from anthrax shall be admitted to the hospital indicated by the trade association.

7. Workers who are engaged in working up raw sheep and goat skins, as also dried imported raw skins, shall not be allowed to enter the lunch room, to take any meals, or to leave the works, until they have divested themselves of their working clothes and have thoroughly washed the face, head, hair and beard, neck, hands, and arms.

The workers shall not be permitted to take beverages in open containers or foodstuffs into the workroom. They shall likewise be forbidden to take meals in the latter.

8. Should the worker become aware of an itching or burning sensation on the head, or pain arising from a darkish pimple, which, although at first of small size, rapidly grows larger, he shall immediately inform the works management and place himself under medical treatment or enter the hospital to which he has been referred, since delay is dangerous and would probably lead to the death of the worker.

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